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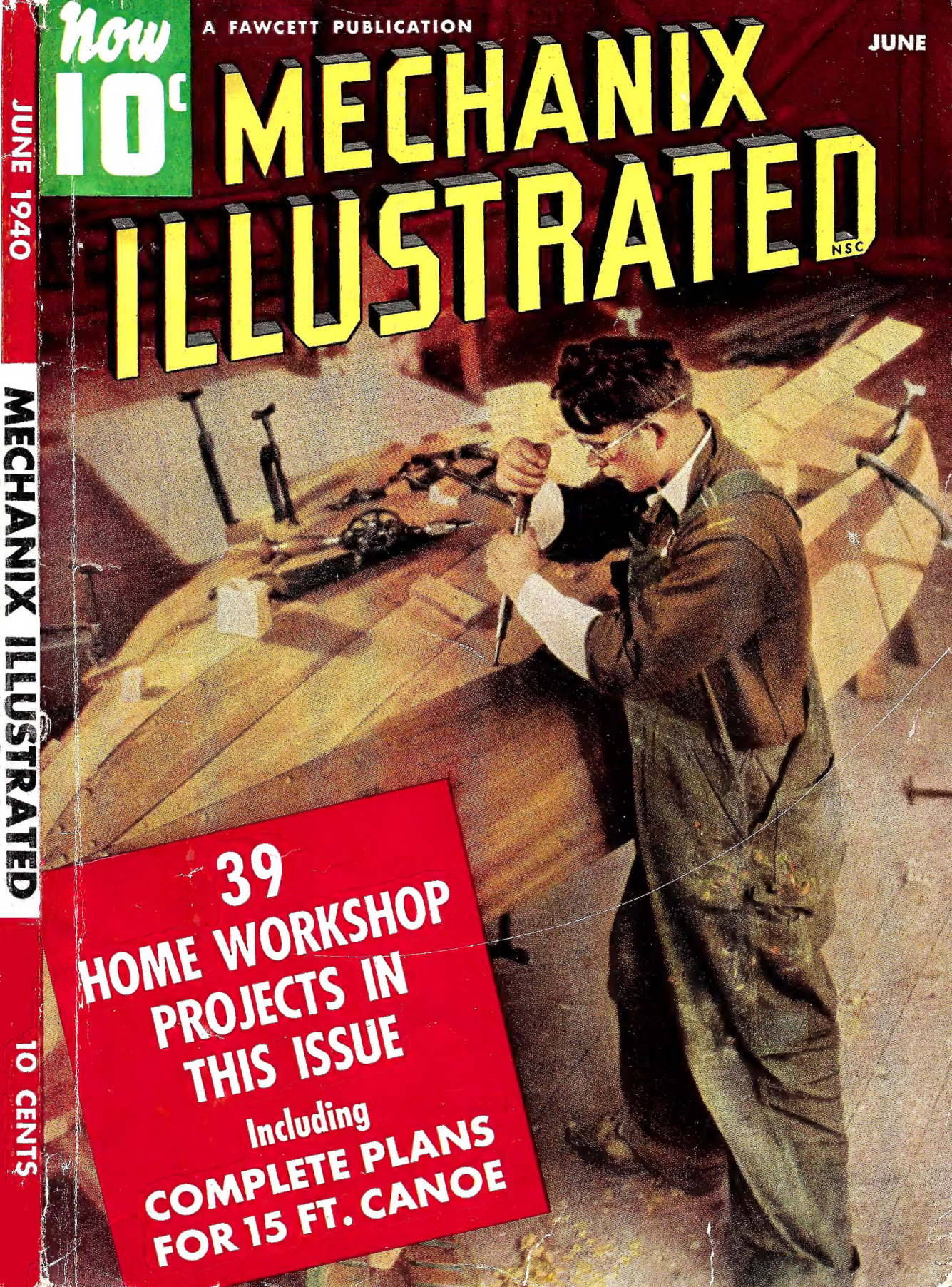

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5.50-17	3.35	1.40
28x5.50-18	3.35	1.40
29x5.50-19	3.35	1.45
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30x6.00-18	3.40	1.40
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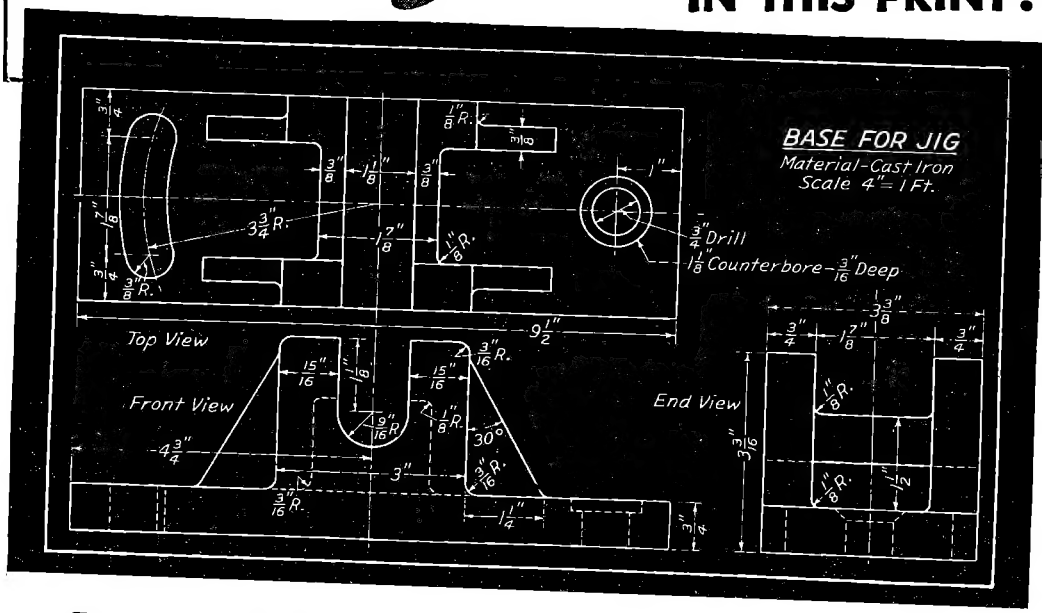

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Published monthly by Fawcett Publications, Inc., 11th Street and Broadway, Louisville, Kentucky. Executive Office—22 W. Putnam Avenue, Greenwich, Connecticut. Editorial and Advertising offices—1501 Broadway, New York, New York. Send subscriptions to the Louisville, Kentucky, or Greenwich, Connecticut, addresses.
Entered as second-class matter under the Act of March 3, 1879, at the post office in Louisville, Ky., with additional entry at Greenwich, Conn. Not responsible for unsolicited manuscripts. In U. S. and Possessions, 10c a copy; $1.00 a year. In Canada, 10c a copy; $1.50 a year. Other Postal Unions, $2.00 a year. Foreign subscriptions and sales should be remitted by International Money Order in United States funds, payable at Greenwich, Connecticut, U. S. A. East Indian Agent P. C. Eranee Sons, Bombay, India. Printed in U. S. A. Advertising forms close the first of second month preceding date of issue. Advertising offices: New York, 1501 Broadway; Chicago, 360 N. Michigan Ave.; San Francisco, Simpson-Reilly, 1014 Russ Bldg.; Los Angeles, Simpson-Reilly, Garfield Bldg. Member Audit Bureau of Circulations.

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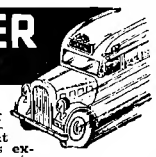

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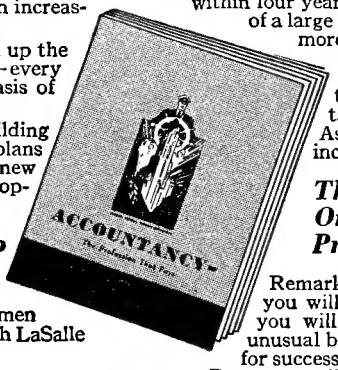

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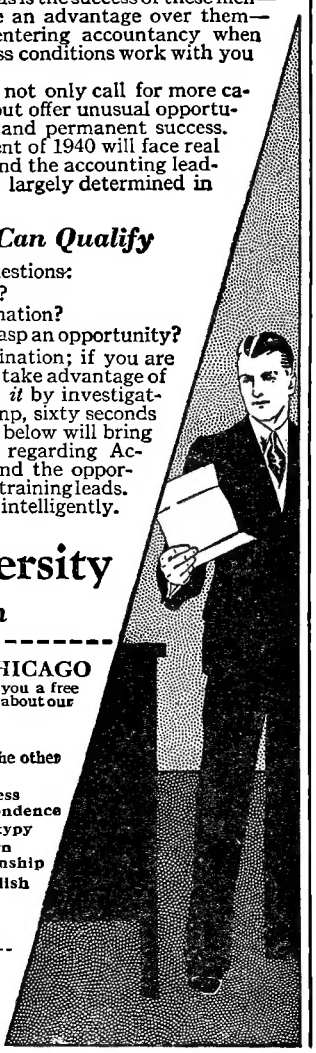

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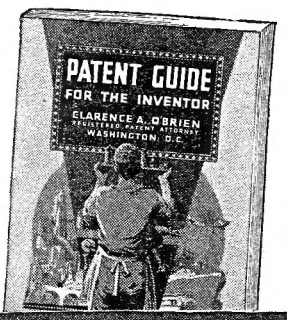

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CHIPS FROM THE EDITOR'S WORKBENCH

Fare Time

ALL advance activities at Flushing Meadows indicate that the 1940 New York World's Fair will really be the event of the century that the 1939 affair was supposed to be but wasn't. The new management consists of practical business men who understand public psychology, and they are grimly determined to make the show a success by first making it irresistibly attractive to people in all walks of life.

They are also pledged not to repeat the sad, stupid mistakes of the 1939 Fair, which got off to a bad start from which it never really recovered. The admission price of 75 cents and the parking fee of 50 cents were too high, and the eating places (other than hot dog stands) were ridiculously inadequate for the crowds that did attend. Furthermore, the many really fine commercial exhibits were overshadowed in importance by the so-called "amusements" which were nothing more than crude burlesque shows dressed up with modernistic lighting.

This year a flat admission price of 50 cents will prevail, and the city parking lots will charge only 25 cents. Scores of large restaurants, with rigidly controlled popular prices, are being erected. The fun zone is being reduced greatly, although there will still be plenty of genuine amusements for both children and adults. The foreign area will show the effects of the European war, but practically all the large commercial exhibits (the real backbone of the Fair) will reopen, larger and more elaborate than before. The article on page 34 of this issue gives only a small idea of the many marvelous things to look for.

If you intend to drive to the Fair this summer, I'd like to suggest that you leave your car near your hotel or tourist home and that you use New York's wonderful (and inexpensive!) subway system instead. You'll save time, money, shoe leather and your good disposition. The various subways, and also the Long Island Railroad's special trains, deliver you right inside the Fair. If you drive through New York's traffic-snarled streets, you'll find that the entrance side of the main parking lot at the Fair is so far from the ticket gates that you'll have to take a bus to get there!

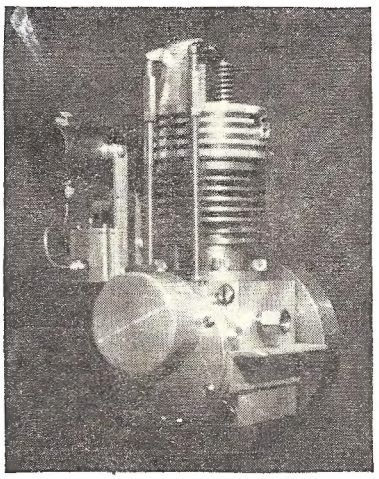
Incidentally, you may not know that a large part of New York's "subway" trackage is not underground at all, but up in the air. As you ride along Roosevelt Avenue on the train you'll get a thrilling panoramic view of the whole Fair grounds, otherwise obtainable only from an airplane or from the parachute jump in the amusement area.

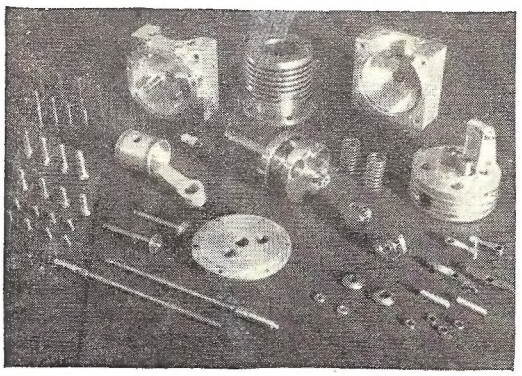
***

Up In The Air

The new Fawcett FLYING MANUAL has been

[*Continued on page* 13]





Hats off to J. C. Magee, 632 N. Brandywine Ave., Schenectady, N. Y., winner of this month's first prize of $5.00! He put 275 hours of meticulous labor into this splendid four-cycle, one-cylinder model gas engine, which has 1.625" bore and 1.625" stroke and turns up at 2600 r.p.m. The job was done entirely on a 12" lathe with only a compound rest and no milling attachment, necessitating some very accurate and difficult faceplate set-ups. These photos show the completed engine and all the parts before assembly.

"I would be glad to answer any questions regarding the making of engine parts on a lathe which would be of any assistance to readers," writes Mr. Magee.

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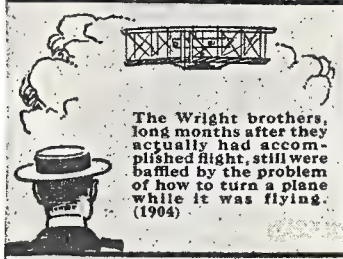
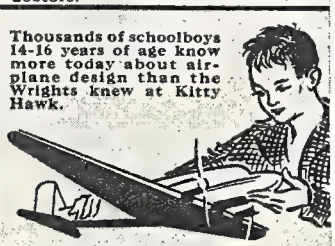
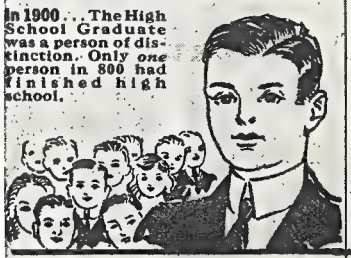
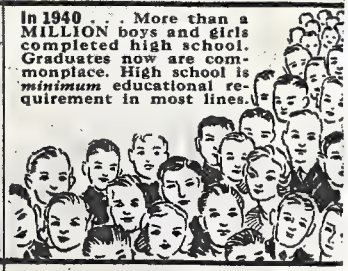
If you are an average grade school graduate, the average man with High School training earns $16.30 a week MORE than you.

YESTERDAY—	TODAY—
In 1900 . . . Many doctors then practicing were not even high school graduates. High School had not been required at the time they entered medical school.	**In 1940 . . .** Schools of nursing require high school graduation because most of them are conducted at *college* level. Progress has made modern nurses' training equal or superior to that available to many old time doctors.
 The Wright brothers, long months after they actually had accomplished flight, still were baffled by the problem of how to turn a plane while it was flying. (1904)	Thousands of schoolboys 14-16 years of age know more today about airplane design than the Wrights knew at Kitty Hawk. 
In 1900 . . . The High School Graduate was a person of distinction. Only *one* person in 800 had finished high school. 	**In 1940 . . .** More than a MILLION boys and girls completed high school. Graduates now are commonplace. High school is *minimum* educational requirement in most lines. 
In 1900 . . . Very few even thought of going to college, unless to enter one of "the learned professions." The number of college graduates in business and industry was so few that they formed practically NO COMPETITION in the average job.	**In 1940 . . .** Almost exactly as many are being graduated from college, today, as from high school 40 years ago. Everywhere—in everything you do—in commerce, industry, personal affairs, you are up against the competition of COLLEGE GRADUATES.
In 1900 . . . The "little red schoolhouse" did a pretty fair job of equipping men and women to make their way in the world.	

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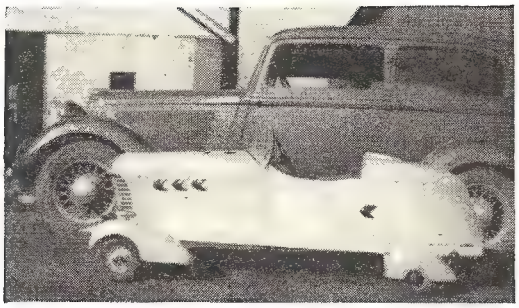
Editor's Workbench Chips

[*Continued from page* 10]

"The novelty of a tree house might interest you," writes Julius Merl, of the Bronx, N. Y. "It was built for practical sleeping purposes. The base stands 23 feet above the ground and is supported by two maple trees. It is 8 feet long, 7 feet wide and 6 feet high and has windows on all four sides. Every bit of construction was done right up in the trees themselves, with the aid of ropes and pulleys. The house is extremely strong and easily withstands winter storms. Entrance is through a trap door in the bottom."

This is a novelty, Julius, and deserves a $3.00 Workbench award.

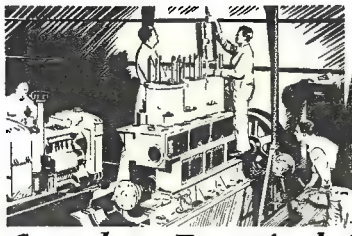


When Alfred Higby and Tom Apple, of Saegertown, Pa., decided to build a midget car, they did a complete job in all respects. One of the features of their trim 7½-foot buggy is open type knee action wheels, constructed of strap iron. The power plant is a 1½ h.p. air cooled motor. The car has headlights, tail-lights, horn, brakes and clutch, and will do close to 40 m.p.h. Must be quite a sight chugging down the road!

A $3.00 award to Al and Tom for this nice snapshot.

out only a few weeks, but already has made a hit with air-minded people everywhere. Stunningly illustrated with many specially-made photographs and engagingly written by aviation experts, it is a worthy addition to any bookshelf. It contains 144 pages printed in brilliant rotogravure

[*Continued on page* 14]



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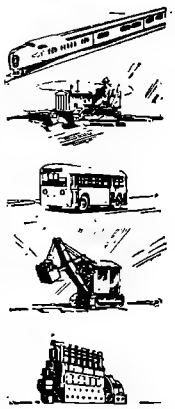

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Editor's Workbench Chips

[*Continued from page* 13]

These before-and-after pictures of the Luscombe Phantom scale model built by Donald Macpherson, of Tucson, Arizona, will evoke many expressions of sympathy from other makers of model planes.

"I believe my error was in not gliding the plane before trying it under power," writes Donald. "I had five unsuccessful flights before the last one, when the motor cut out. The ship went into a dive from an altitude of about 100 feet, and this is the result."

Too bad, Don. Anyway, you'll receive a $3.00 Workbench award and we hope you'll apply it to the purchase of a new model.

and . . . this is the surprise . . . it sells for only 50 cents a copy. One enthusiastic reader writes:

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The feature article in FLYING MANUAL deals with Army aviation, and was written by Major General H. H. Arnold, Chief of the Air Corps and

[*Continued on page* 16]

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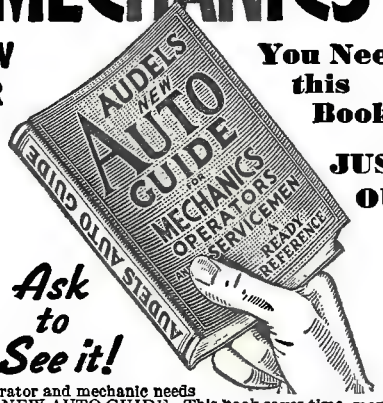

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Editor's Workbench Chips

[*Continued from page* 14]

for several years aviation editor of this magazine. *Everything* in this new book is authentic and up-to-the-minute.

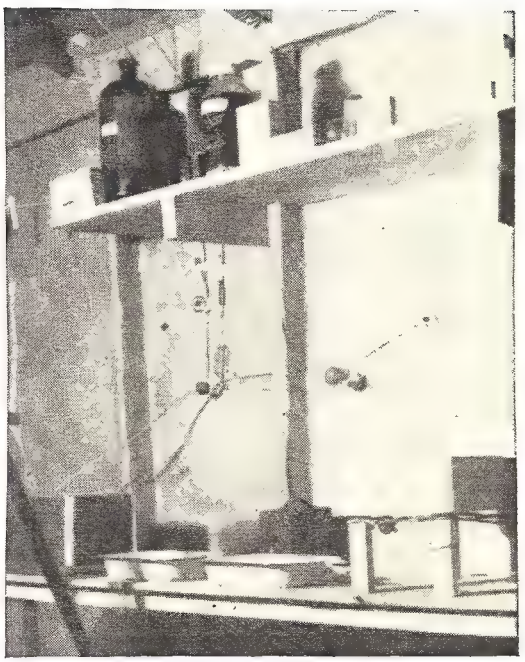
***

Ahoy!

Boating is rapidly developing as one of the major outdoor activities of the United States. And with good reason! Travel on water is clean, leisurely, comfortable, inexpensive. A single gallon of gas will keep a small outboard or inboard powered family boat chugging along all day! There's double pleasure to your week-end sailing if you have built your boat yourself, as many readers of MECHANIX ILLUSTRATED and HOW TO BUILD 20 BOATS have learned.

Sales of MI boat blueprints have been growing by leaps and bounds. We hit a new record recently when more than a thousand blueprints went out during a single month! And the places to which they go! A whole new breed of land-locked sailors is developing in inland corners of the country as a result of the creation of huge artificial lakes behind Norris and Boulder Dams

[*Continued on page* 18]



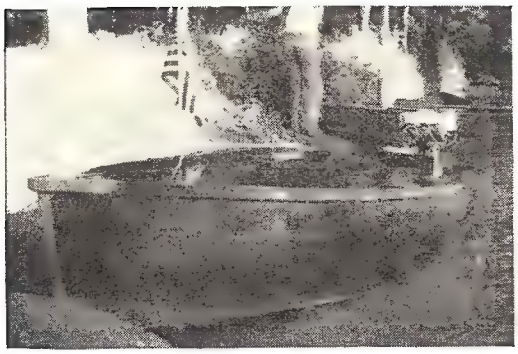
A cellar darkroom needn't be an elaborate affair. This view of the "lab" of Anthony Brocato, Jr., of Cleveland, Miss., proves it, and also wins a $3.00 Workbench award.

"My darkroom was formerly a storeroom, with cracks in the wall. So I bought a roll of thick wrapping cardboard and tacked it on the walls, with overlapping joints," writes Anthony. "Now it is really dark. I can work in it during the daytime without trouble."

Editor's Workbench Chips

Here are some more examples of readers' handicraft. Why not send in pictures of *your* projects?

This formidable looking motor scooter was built for heavy work. According to its builder, Edwin Bristow, of Owensboro, Ky., it will carry 300 lbs. and will start from a standstill with 200 lbs. The motor is only a ¾ h.p. unit, but speed was sacrificed for power by means of a suitable belt system. A $3.00 award for this excellent snapshot.



Remember "Patty," the trim convertible sailing skiff described in the last HOW TO BUILD 20 BOATS? Here is a super-deluxe version built by W. S. Malott of Marion, Ind., which certainly deserves a $3.00 prize. It is built of redwood, red mahogany stained, with four coats of spar varnish. The inside is enameled cream and all fittings are brass.

"'Patty' attracts attention everywhere I take her because of her beauty and small size," proudly writes her builder.

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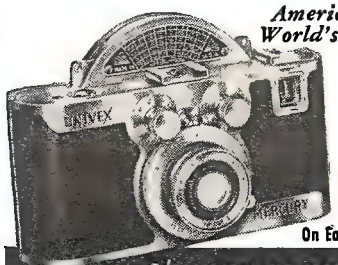

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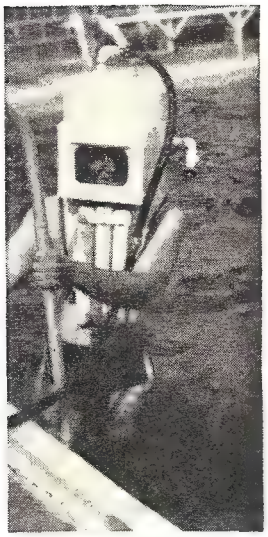
Editor's Workbench Chips

[*Continued from page* 16]



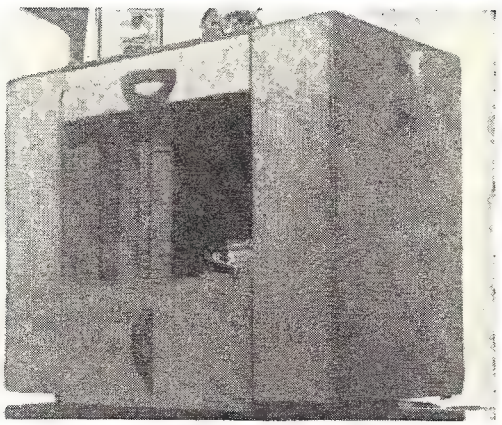
Man from Mars? No, it's John Prentice, of Medford, Oregon, wearing an ingenious diving helmet he made himself at practically no cost. Both the helmet and the reserve air tank were fashioned from a discarded hot water tank. The window sash weights on his chest were rescued from a demolished building, as were the control valves. The air hose, fifty feet long, was borrowed from the home garden.

"Only two pounds of air pressure is sufficient to keep the water out," says John. "I have stayed under water for half an hour at a time, and came up only because the fellow on top stopped pumping air to make me come up and give him a turn. The manager of the local swimming pool lets us in free every time we bring the helmet, because it attracts so much attention. I'll be glad to answer any questions."

You've asked for it, John; you'll soon be swamped with mail! However, keep an eye peeled for an MI envelope containing a $3.00 check for you.

and at other points where large-scale water control projects have been completed. These are veritable boating paradises, with gorgeous scenery and scrappy fish thrown in. Many of our most successful boat builders are the small-town handy men and craftsmen of these regions. With some misgivings, they order blueprints and pore over them for days before they dare cut a plank. Then they discover that small boat building is not

[*Continued on page* 19]



This modernistic utility table would be a credit to any cabinetmaker. It was built by Walter A. Harper, of Charlestown, Mass., from plans that appeared in MI three years ago, and wins a $3.00 prize check.

"It is the handiest piece of furniture in the house," says Walter. "I use it for books, drawing tools and photo materials."

Editor's Workbench Chips

[*Continued from page* 18]

"This photo shows a wind-charger which I constructed from an auto generator, a bicycle fork and other parts from the local junk yard," writes Adrian Krueger, of Danube, Minn. "The charger is self-governing; the generator tips backward as the velocity of the wind increases. The propeller was carved from white pine."

An ingenious combination of parts, Adrian, and you deserve a $3.00 Workbench award for it.

nearly as difficult as they had thought and that boat power plants are kindergarten stuff compared to auto engines.

"Shucks, there's nothing much to it," writes a typical boat convert who lives in Tennessee. "Anybody who's ever put up hen houses or repaired a barn can make a boat. All you need is a couple of sharp saws, an accurate tape measure, a hand drill, a pot of glue and a big can of elbow grease. Your blueprints are swell for dubs like me. Keep up the good work."

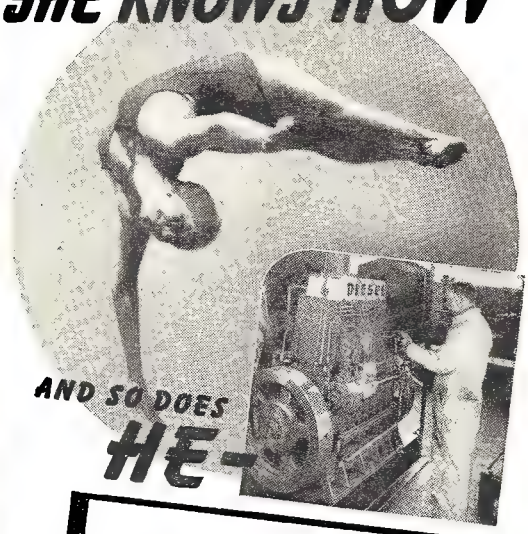
***

The *Benjamin F. Packard*

Roland Cueva is boating editor of MI. He has answered thousands of letters on boat problems from readers all over the world. Out of these he has slowly developed what he modestly considers is the ideal all-round craft that will satisfy the general requirements of the greatest number of builders. He has used up about an acre of

[*Continued on page* 20]

SHE KNOWS HOW



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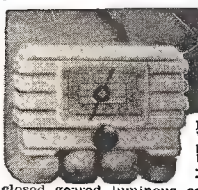

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Editor's Workbench Chips

[*Continued from page* 19]

paper for rough sketches, and has made scale models galore to test the lines of the more promising jobs. He has consulted with Sam Rabl, N. A., whose many excellent designs for MI and HOW TO BUILD 20 BOATS need no introduction. Now, finally, the composite boat is actually under construction in his garage. Step-by-step pictures of its assembly are being made, and the whole story, drawings and all, will of course be published in MI and in next year's edition of HOW TO BUILD 20 BOATS.

Temporarily named *Benjamin F. Packard* (don't worry, that will be changed!) Cueva's creation will be a V-bottom job 18 feet long, with 7 foot beam. Planking, marine plywood. Sloop rigged. Cabin for two. Air-cooled 3 h.p. inboard. In other words, the kind of boat you can build conveniently yourself without special equipment, and one that is suitable for lake, river or salt water service anywhere.

Has anyone any ideas about a suitable name? A bag of sawdust from Roland's garage for the best suggestion!

The launching ceremony will be done in full style, with one exception. Roland plans to *drink* the champagne and to break the empty bottle over the bow.

"Think I want the paint dissolved by the turpentine in the champagne?" he says. "Nothing doing!"

***

Contest Corner

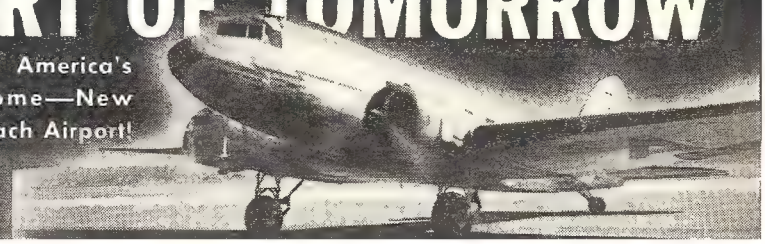
The Tobacco Can Contest announced in the March issue has been very successful. In fact,

[*Continued on page* 22]

"Should anyone care for the plans for this model cruiser I would be only too glad to furnish them," writes Charles Beavus, 5033 Princeton Street, Philadelphia, Pa. That's a pretty generous offer and we hope other readers don't swamp him with requests. Named "The Careless," this neat model is 40 inches from stem to stern and is powered with a home-made steam engine. For this good action photo, Charles earns a $3.00 "Workbench" prize.

AIRPORT OF TOMORROW

Behind the Scenes of America's Most Modern Airdrome—New York's Great North Beach Airport!



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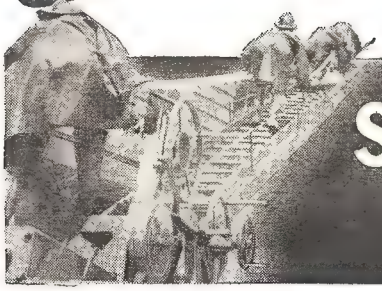
Latest developments in ultra-scientific designing. How it's done—and why!



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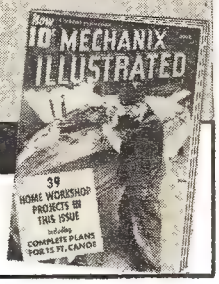

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Editor's Workbench Chips

[*Continued from page* 20]

so many ingenious contraptions came in that we couldn't quite finish the judging in time to announce the winners in this issue. We'll have the full report in the July issue instead.

This modest little contest was frankly an experiment. We were surprised to note how much time and effort some readers put into their entries. The total prize money was only $50, so the affair was more or less a sporting one. In our next issue we will announce another contest, with bigger stakes. This time the medium will be cigar boxes. They are universally obtainable at no cost, the wood is thin, easily worked and usually of good quality, and an endless variety of useful and ornamental objects can be made out of it. You might start collecting boxes now and begin thinking up ideas.

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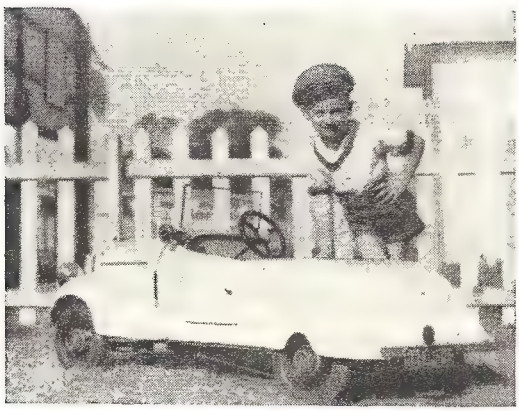
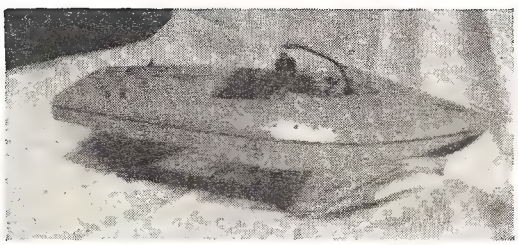


"This picture shows my son Craig, age 6, with the midget car I built for him. I got a lot of ideas for its construction out of your magazine, and added a few of my own," writes John Sutner, of Los Angeles, Cal. "It has independent front wheel suspension and a complete braking system. There's no engine in it yet, but I'm going to install a ¾ h.p. job soon."

That's an exceptionally neat little car, John. We hope that you save the $3.00 prize award you will receive, and apply it to the purchase of the engine.

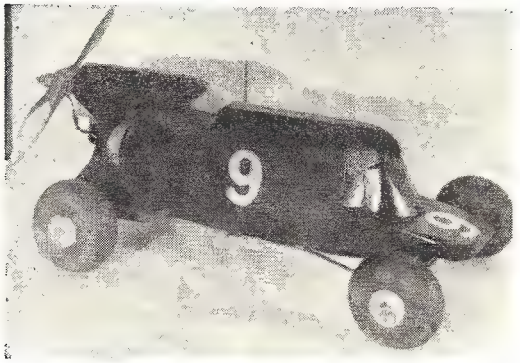


"I wish to submit this photo of a speedboat I built from the plans for 'Yumping Yimminy', appearing in the MODEL BUILDER'S HANDBOOK," writes Kurt Maler, of Brooklyn, N. Y. "The boat is powered by a ⅕ h.p. motor and weighs four pounds complete. The materials cost me six dollars, less the motor, and I think this was the best investment I ever made. It took me about a month of spare time to construct this boat."

And a graceful little job it is! A Workbench prize of $3.00 is going to you for the letter and the picture.

Editor's Workbench Chips

[*Continued from page 22*]



Racer No. 9 was built from the "Whirlwind" plans that appeared in the March 1940 issue of MI. It is the product of the combined efforts of R. S. Turrell and Frank Remsey, of Modesto, Cal., who win a $3.00 Workbench award.

Full-size blueprints of the "Whirlwind" are available from MI for one dollar a set, postpaid.

Pastimes On Parade

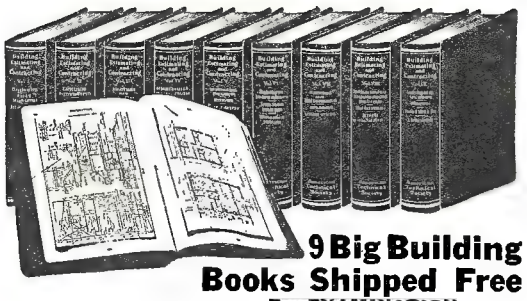
If you expect to be in or near New York the week of September 7, 1940, by all means drop around to Grand Central Palace and spend some time seeing "Pastimes on Parade." This new "hobby show" promises to be an exciting event, with all kinds of demonstrations and stunts going on. The exhibitors plan to avoid the usual "static" display that characterizes so many other affairs; they are arranging for "dynamic" exhibits that show how things are done or made. For instance, instead of merely showing an assortment of power tools or photographic flood lights, they will have the machines in actual operation and they will have models posing under the lights so that you can snap pictures of them. Hobbies from pin engraving to flying will be included.

MECHANIX ILLUSTRATED expects to sponsor a model builders' contest, with valuable merchandise awards for the best model boat, automobile, airplane and railroad locomotive or car. The prize winners will be displayed at Grand Central Palace. Entry blanks are being prepared. If you already have on hand some pet model in any of these four classifications, you might drop me a card or letter, simply saying, "I'm interested in the model contest. Please send me full information when ready." We'll take care of the request in plenty of time.

***

Pose Please!

We are always glad to receive pictures of workshop projects. For the best snapshot received each month we pay $5.00, all others published win $3.00 each. Don't forget to tell me how much time you spent on the job, what materials you used, etc. And by all means get into the picture yourself—*Robert Hertzberg*, Editor.



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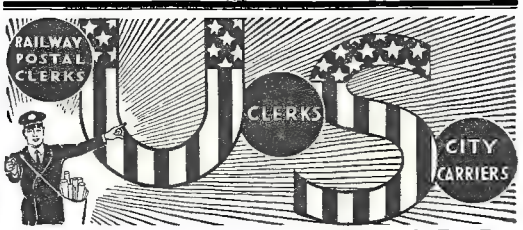
Please attach a letter stating your age, employer's name and address, and that of at least one business man as a reference.



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Through The PERISCOPE

The most unique way of working one's way through college that has come to our attention in a long time is the method used by George Vincent, a junior in the New York State College of Forestry at Syracuse University. George is a trapper, catching muskrats and other small fur animals within a radius of 20 miles from Syracuse. Each morning he tramps ten or twelve miles to inspect his traps and remove whatever catch may be waiting, and then hitchhikes his way to class!

* * *

Bees are the original "jitter-bugs." Or it might be closer to fact to call them interpretive dancers. At any rate, they do dance, and their dance means something to their hive-mates, according to Professor K. von Frisch of the University of Munich in a recently published report.

When a bee finds nectar, she flies back to the hive and does an excited dance amid her fellow workers. These join her for a few steps, and then make off for the new source of honey-material.

[*Continued on page* 25]

By Looey Graff

"Would you mind standing still a minute—I'm developing some films!"

Through The Periscope

[*Continued from page* 24]

by Frank Smart

"Next time you call a radio repair man, be sure he's not our downstairs neighbor!"

A novel position for airplane pilots seriously suggested in Germany is lying on the back or stomach, rather than sitting up in the conventional way. The reason given is that blood circulation in this position can endure greater speed acceleration without strain.

* * *

Now that spring is here, disciples of Isaac Walton are regarding their fishing tackle with contemplative eye and entertaining vague ideas of where to go for their first 1940 fishing expedition. The Fish and Game Department of the Canadian National Railways has for the past few months been amassing information concerning the better localities in Canada the sportsman can visit and this information is contained in the booklet "Hunting, Fishing and Canoe Trips in Canada."

Ernie Pool, Fish and Game Representative of the company states: "In addition to the regular waters for game fishing from coast to coast, new fishing lakes have been discovered and opened to sportsmen; new waters have been planted with game fish and the angler will find unexcelled sport for many varieties of game fish."

So if you're not wading around up in one of those Canadian creeks stalking the big ones, don't blame us—we told you!

[*Continued on page* 26]

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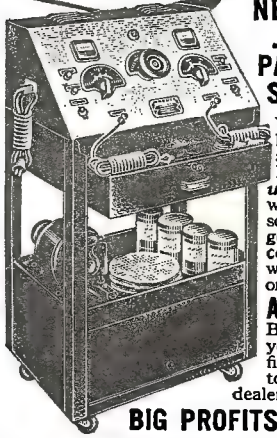

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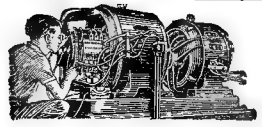

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(I say this Reverently)

In THE BOOK we read "Ye have not because ye ask not" and "Whatsoever ye shall ask in My name, I will do it" and "Ask and it shall be given to you" and "Everyone that asketh receiveth." YES, I claim that GOD wants to work for you, and is anxiously waiting to do your bidding. There are great astounding secrets of success, prosperity and health hidden in the Bible. Christ taught and demonstrated them, but Church Doctrine has overlooked them. Have you ever read "Seek first the Kingdom of God and all these things shall be added unto you"? Do you know what it means? My Friend, the Miracle Power of God will add Health instead of Dis-Ease. Prosperity instead of Poverty. Joy instead of sorrow. Power instead of Weakness. Helpmates instead of Help-less-ness. Courage instead of Fear. Romance instead of Loneliness, in fact everything that is good for your well-being. For the past TEN YEARS I have been teaching these Truths to scores of Students and I have condensed them into a Booklet entitled "THE SECRET PLACE". With your order of this booklet, I will send free (as long as they last) three valuable Manuscripts on "Divine Health". STUDY FIVE LONG DAYS, if not satisfied, mail back and your investment will be returned to you at once. **DO NOT SEND ANY MONEY.** Just drop a postal card to me at once, stating you will pay the postman the small sum of ONE DOLLAR plus a small postal fee, and I will mail the Four books to you C.O.D. Of course you save postal fee by sending $1.00 cash. Only a limited number of Manuscripts given free so send order immediately. Write to

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Through The Periscope

[*Continued from page* 25]

We agree with the dentists that brushing your teeth is a fine habit, but we think it can be carried too far. Take Joe Fayder of Jersey City, for instance. Joe was brushing his molars enthusiastically one morning when the toothbrush disappeared. It startled Joe, and no wonder . . . the X-ray found it—in his stomach!

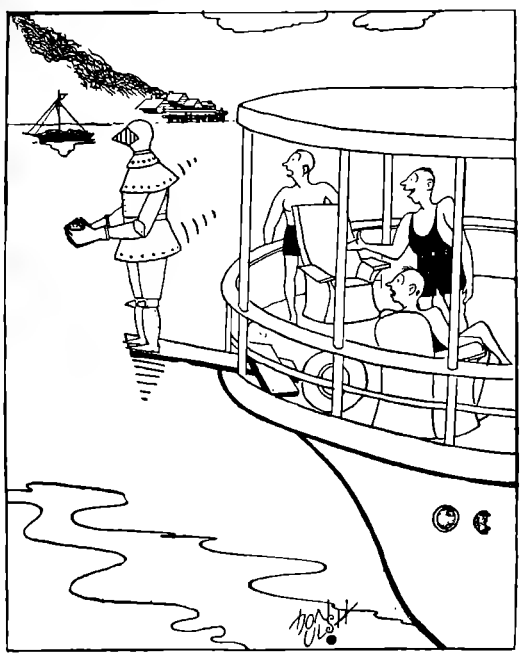
* * *

Inventor Lester F. Barlow has won the latest round in his battle to have Army and Navy experts give his liquid oxygen-carbon explosive bomb a thorough test. Just as effectively as his bombs demolished a shed at a distance of twenty feet, so has Barlow made die-hard skeptics retract their belief that the bombs could not be made safe to handle.

Barlow and his collegue, B. G. Holderer, did everything but jump on the bombs to prove their safety from shock at the proving ground of the Martin airplane plant at Middle River, Maryland, recently. They burned the bombs, fired rifle bullets into them, shot them out of a trench mortar 500 feet into the air, shot them against a steel plate so that they ricocheted 300 feet—all without explosions.

After each "safety" test they took the battered bomb and exploded it with startling effectiveness by blasting caps.

[*Continued on page* 27]



By Don Ulsh

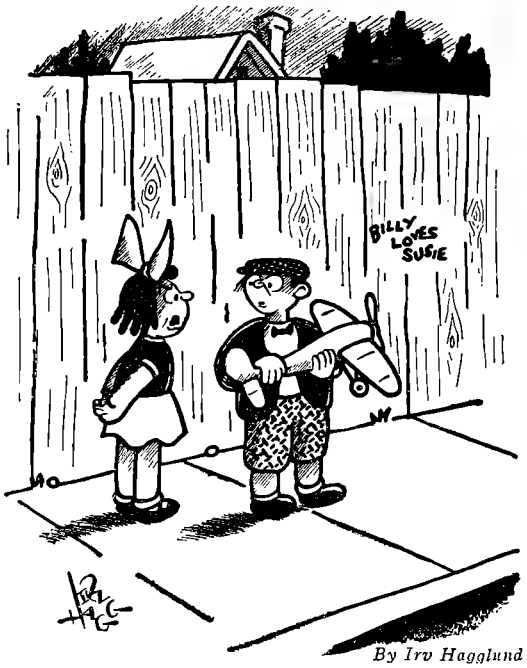
"He says it's his newest invention . . . a protection against sharks!"

Through The Periscope

[*Continued from page* 26]

We're always learning something: It seems that the waffle-like markings on ice cream cones are a survival from the first cone, which was a waffle rolled up to hold an ice cream ball.

And the carnation flower gets its name from "coronation" because in medieval times it was used in crowning religious statues on feast days.



By Irv Hagglund

"I won't marry you until you give up flying!"

We see that in downtown Galveston, Texas, air-conditioning will be operated as a public utility on a metered service. There's always something —now, you'll just get through paying for the winter's coal or oil when the bills will start to come in for the summer's cool air!

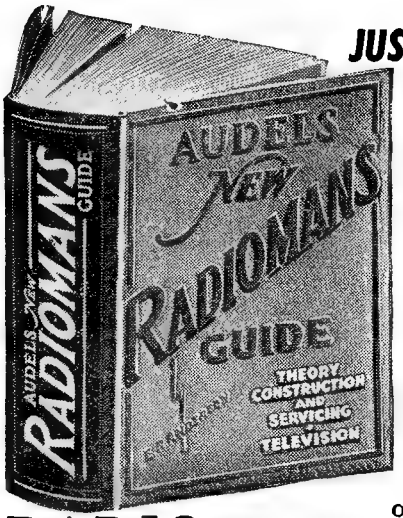
* * *

SSSS . . . doesn't necessarily mean to keep quiet. Upon authority of the Federal Communications Commission, it is rivaling the internationally recognized SOS distress call as a signal sent by marine operators in time of danger. The dot-dot-dot four times repeated (. . . . . .) is a sort of swing call for a swing-time age which through usage and common understanding has taken on the meaning of SOS and the older CDQ. Contrary to popular belief, SSSS doesn't mean "submarine sighted" or anything else. Not anymore than SOS means "save our souls" or "save our ship."

They're just signals.

[*Continued on page* 28]

JUST OUT!



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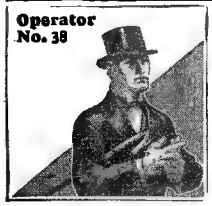

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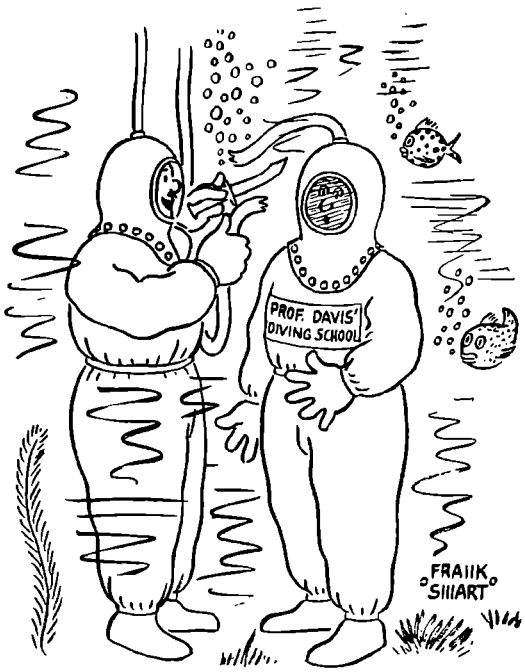
Through The Periscope

[*Continued from page 27*]



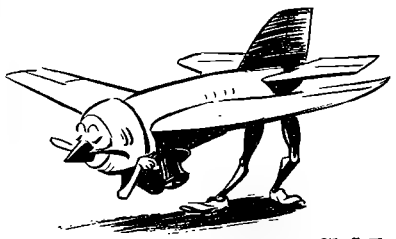
by Frank Smart

"Now this line is to breathe through. There, see what I mean?"

Congratulations to America's commercial airlines!

The 26th of March marked a complete year when not one fatal accident occurred, and it was a year, incidentally, that saw more passenger miles flown than ever before. When an airline plane *does* crash, we see it in front page newspaper headlines, we read about it on the editorial pages, we see pictures of the wrecked ship in rotogravure sections and newsreels—but how many papers gave the year of safety a headline, or even an editorial?

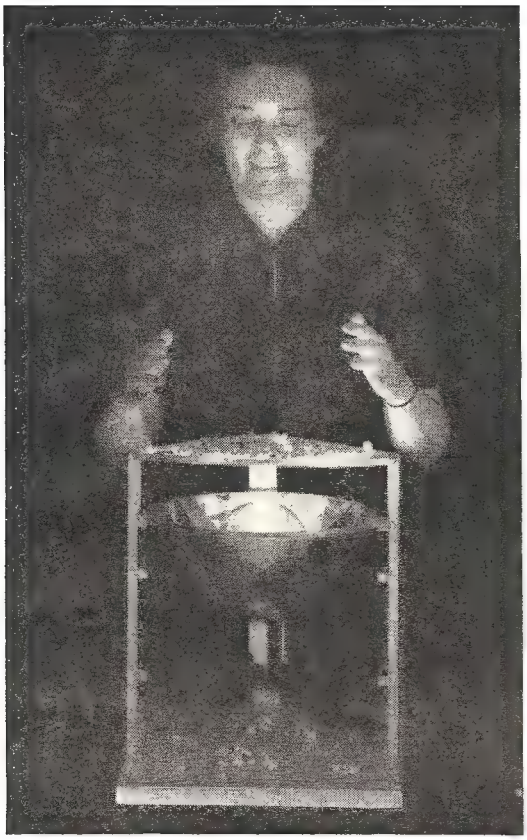
It doesn't seem fair . . . so step up, airlines, and take a bow!



—Cliff Taylor

Navajo Indians no longer wear the blankets that they weave for sale—they themselves have taken to lighter commercial shawls and blankets.

Make Popcorn By Lamplight



Development of a complete line of drying lamps, designed to produce a wealth of effective infrared (heat rays) instead of light, has just been announced by the lamp department of the General Electric Company.

Most powerful of the four infrared sources is a 1000-watt unit. Of medium intensity is the 500-watt unit. There are two 250-watt drying lamps: one requiring special reflector equipment, as do the 1000- and 500-watt lamps; the other having its own reflector "built into" the bulb.

Use of the new lamps in a wide range of trial installations clearly shows that heat from the lamps can be used to great advantage in a variety of industrial operations. Radiation from the drying lamps is of such a nature as to dry photo prints, industrial finishes of many kinds, food stuffs, paper products, and the like, faster and at less cost than conventional drying equipment has been able to do. The new line permits users to speed up process drying, expedite surface heating, and to facilitate today's trend toward straight-line continuous-flow production.

Owing to low heat losses, efficient directional control, light weight of equipment, a drying set-up using the lamps permits new economies in this phase of industrial operation.

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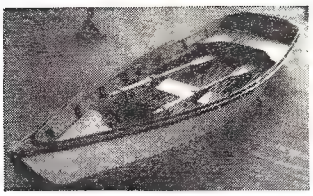

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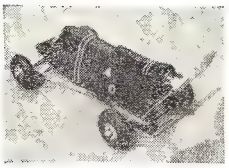

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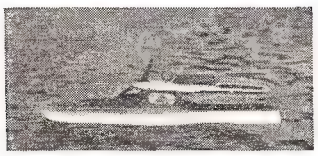

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In human beings this vitamin prevents and cures the serious nervous disorder known as beriberi. In garden and field it is also useful. In addition to making plants grow vigorously and producing abnormally large flowers, this vitamin allows the transplanting of flowers and trees at any season.

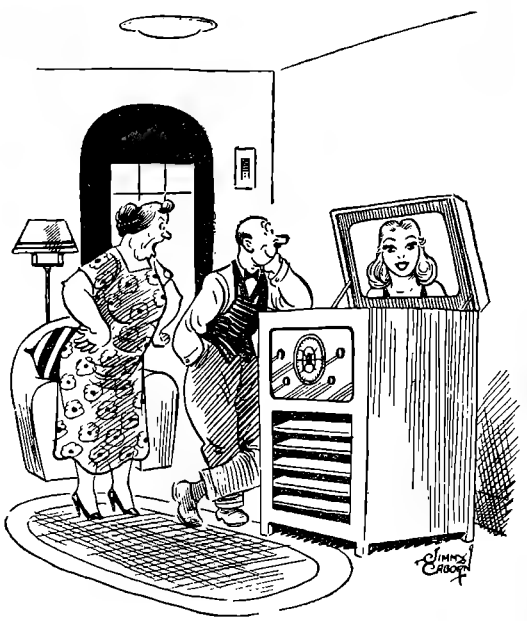
Studies Show That Man Is The Longest Lived Mammal

Longest-lived among mammals is man himself, it is indicated by Maj. Stanley S. Flower, British zoologist who has collected data on this much-discussed subject for many years. Centenarians are found with increasing frequency nowadays, Major Flower states in the current issue of *Fauna,* and he has one apparently authentic record of a human being reaching the age of 114 years.

The elephant, which was long supposed to top man for age, is an exceptionally long-lived animal even though its oldest veterans fall a couple of years short of the half-century mark. Other long-lived big animals in Major Flower's records are a rhinocerous that lived to be more than 40 and a hippopotamus that reached the age of 41 years and 6 months.

Size, however, has no necessary connection with age: figures for lion, tiger and domestic cat are 25, 19 and 20 years, respectively. Record age for a captive gorilla is 13 years, for an animal still living at the Philadelphia Zoo, while a little Cebus monkey nearly doubled that figure, dying at 25.

Ages of 500 years and more, claimed for turtles and tortoises have proved to be exaggerations. However, there are apparently authentic records of tortoises reaching ages of 125 and 152 years, and a somewhat less dependable figure of 123 years for a common box turtle. Outside the turtle family, reptilian ages are not extraordinary.



By Jimmy Caborn

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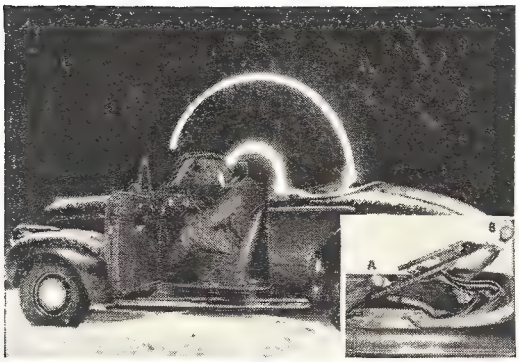
Automobile Test Makes An Unusual Photograph



Typical of the backstage work which must be carried on continually to make sure that automotive innovations are "right" before they are introduced to the public is this cold-weather test to which the vacuum mechanism of the new Chevrolet cabriolet was subjected, not once but countless times, during the development period. To record the test photographically, a light bulb was placed on the front edge of the cabriolet top and another at the end of the forward supporting frame, as shown in the inset. At a signal, the camera shutter was opened, the car's engine was started, and Claude Conklin, of the Chevrolet staff at the General Motors proving ground pulled the dash control which causes the motor vacuum to open the top. The lights then traced the smooth curves as the top was opening. As it reached the lowered position flashlights near the camera illuminated the whole scene.

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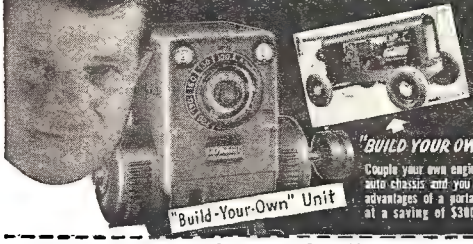

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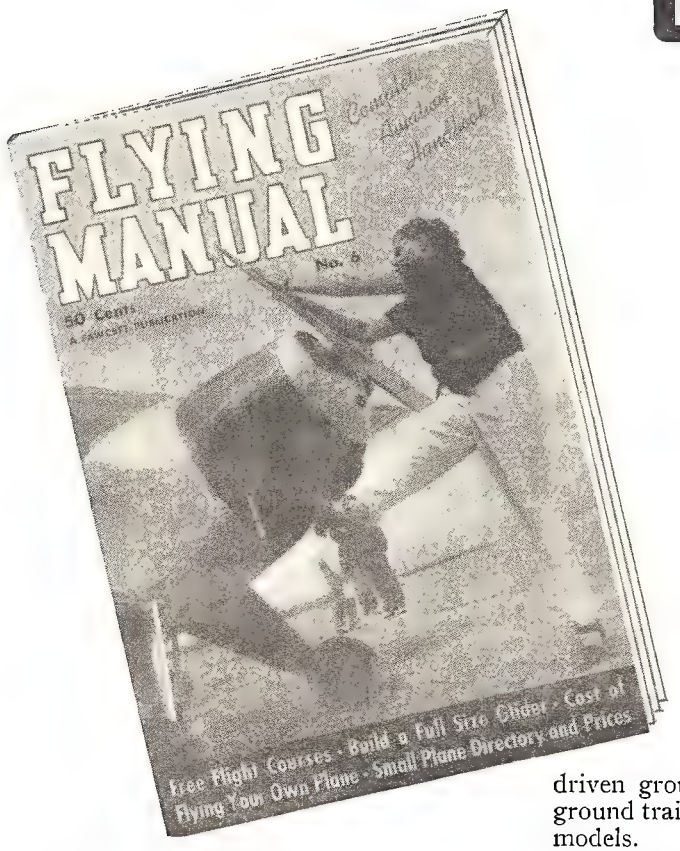

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Vol. XXIV
No. 2

MECHANIX ILLUSTRATED

JUNE
1940

Unchanged in its outward appearance, visitors who look within the Fair this year will be beguiled and mystified by new scientific and industrial exhibits.

A New FAIR for '40

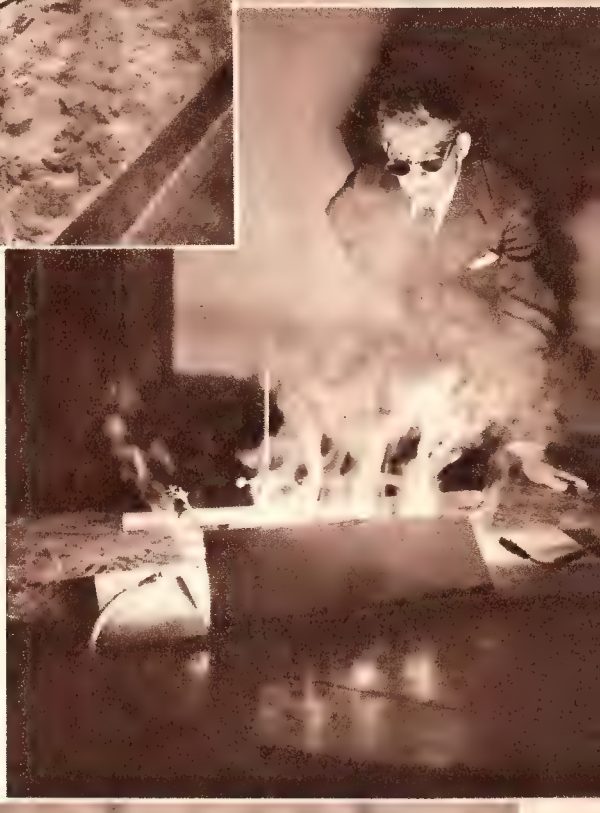
Reduced entrance fee attracts millions of visitors to the 1940 New York World's Fair where science and industry are staging the greatest show on earth free to the public.

by Stanley Gerstin

A MECHANICAL brain that can outwit an Einstein . . . an electrical dog that obeys commands, barks but doesn't bite . . . a motor that runs on lemon juice . . . an electric bulb that can be "blown" out and relit with a match . . . a wire that vaporizes before your eyes . . . a laboratory Frankenstein that talks in cultured English . . . an animated Futurama . . . these are but a few of the spectacular new scientific wonders conceived in the laboratory by the most ingenious mind of all—the mind of man—to entertain and confound visitors to the 1940 New York World's Fair.

The Wonderland of Science, the House of Magic, the Home of Thunder, the Hall of Man and a hundred other centers of science and industry will attempt to outdo each other with new attractions to lure the crowds scheduled

Left: General Motors' popular Futurama features animated autos and trains traversing its super highways and tracks. Below: Infra-red radiations from a super mercury vapor lamp set fire to an asbestos board in a Westinghouse show.

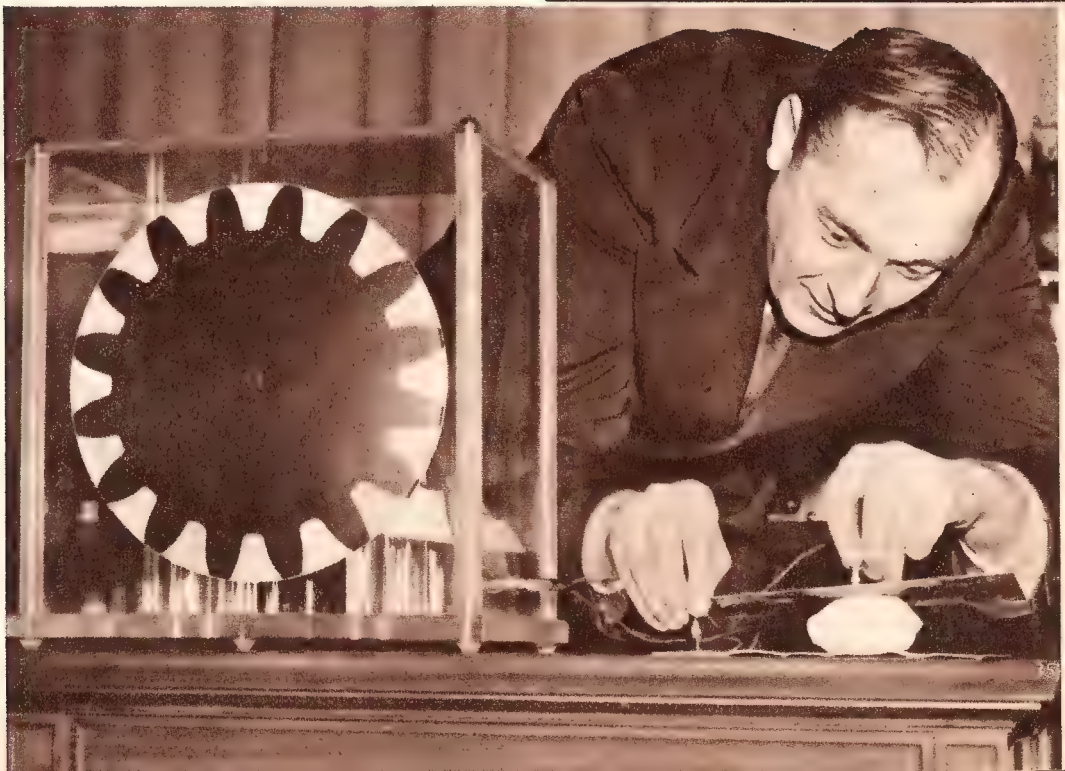


to descend upon the greatest show on earth which opens May 11.

And the beautiful part of all the new attractions, from the visitor's point of view, is that the World's Fair will accommodate millions of sightseers at a reduced entrance fee of only 50 cents. This is a one-third reduction in price over that of last year and should result in bringing even more of the hoi polloi to marvel at the Fair's scientific spectacle. Commercial, scientific and industrial exhibits are free, so that on the basis of the low admission rate, everyone can get far more than his money's worth.

Although the Fair typifies our scientific and machine age, it also pays homage to an age

Below: One of the highlights of the show in General Electric's House of Magic is this machine that runs on lemon juice!



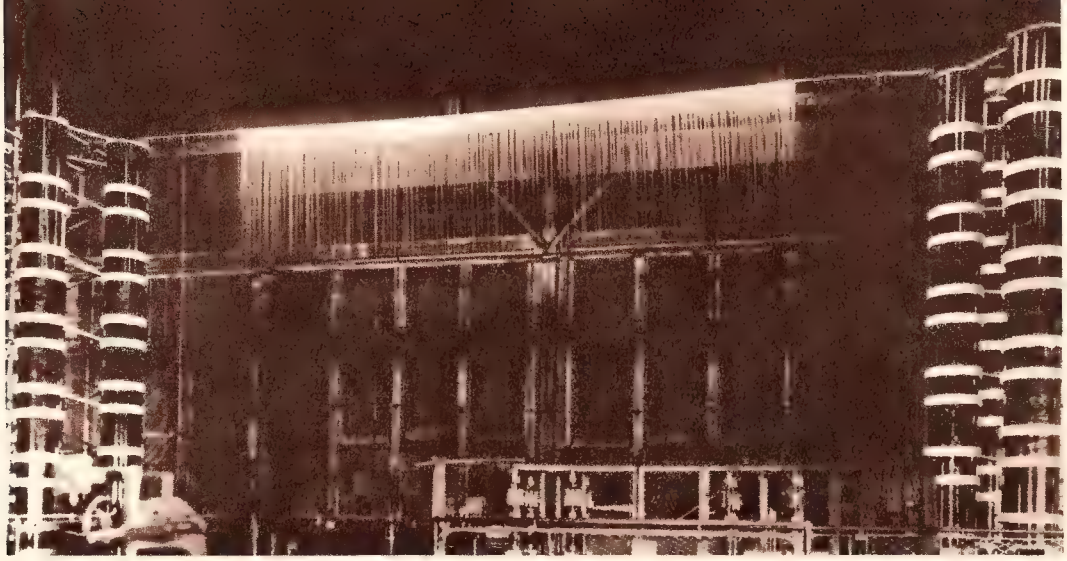
Above: Pedro, the Voder, performs for admiring crowds at the Bell Telephone exhibit. Pedro talks in a perfect English accent and is controlled by the girl operator at a small keyboard. Below: The famous Futurama, which is animated this year, is shown in its construction stage.

of leisure, of laughter and fun. And to further this end dance pavilions, "name" orchestras for both dancing and concerts, theatres and extravaganzas contribute their share in catering to the whim of a varied and exacting public.

Outwardly the same as last year, the Fair has taken its season's experience in stride and instituted changes that will please and beguile the most critical. It's alive! And the visitor's wonder might well be comparable to the wonder of Dom Pedro, Emperor of Brazil, who visited the Philadelphia Centennial Exposition many years ago. He picked up a telephone receiver, eavesdropped on someone's conversation and exclaimed, "My God, it talks!"

No less a wonder to the layman, the new Fair does talk and walk and breathe in the person of the "pain-man" in the Hall of Man; in Elektro, the mechanical man, and Sparko, his robot dog; in Nimatron, the human brain, and Pedro, the electrical voice.

Hen-pecked husbands will be particularly sympathetic to Pedro because, although blessed with the gift of speech by his engineer-creators, he can only talk at the will of his girl operator. By controlling a machine that looks like an old-fashioned organ with a keyboard and a foot pedal, the girl operator



10,000,000-volt generators are used to vaporize a wire and make it disappear in a shower of blinding light in a thundering exhibition in Steinmetz Hall.

can make Pedro say what she wants; can prevent him from talking back!

With Elektro, the "tin man," and Sparko, the mechanical dog, the situation is somewhat similar as both are made to perform several score tricks without a comeback to their human operators. Sparko has the only recourse, and that is the capacity of shaking his head in approval or disapproval of his master (which may or may not be edifying to his self-respect as the case may be).

In the case of Nimatron, the human brain, he will match his wits in a game of "fiddly-sticks" with any visitor at the Fair. The game must be played according to a mathematical formula and "Nim" will be quick to benefit by any misstep of his opponent's, to win the round. "Nim," like Sparko, was developed by Westinghouse engineers.

In addition to the wonders of the human brain and the robots that walk and talk, there is a spectacular machine known as the "breath relay," whereby an electric light is blown out with the breath and relighted with a match! This is a trick that goes beyond the calculations of Thomas Edison who invented the electric bulb. It is accomplished with the aid of a cathode grid glow tube which throws a switch, turning off the light, when moisture from the breath condenses and chills the grid tube. A lighted match brought near an electric eye closes the circuit again and the bulb relights.

No less amazing than the breath relay is the motor that runs on lemon juice! It sounds phony, and the critical observer might be inclined to look under the table or behind a curtain for hidden wires, but he will be disappointed. The lemon juice is used to pro-

Below: This is the "breath relay" whereby the operator blows out an electric bulb and relights it with a match! No magic, just a little scientific trick being performed in the Westinghouse Electric Company show.

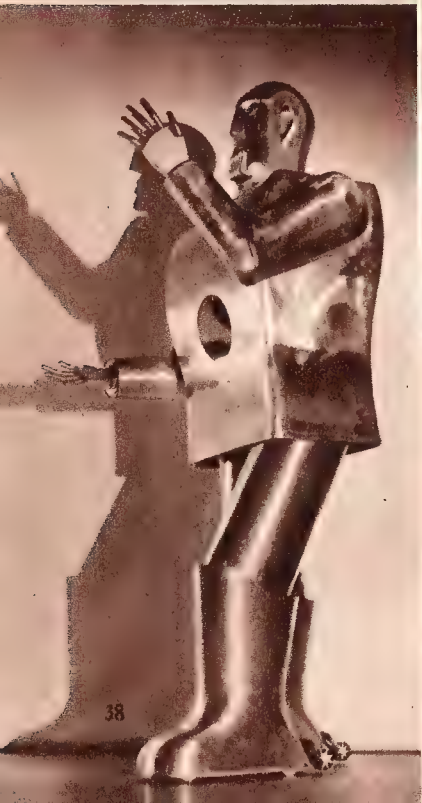
Above: A luminous spiral of glass rises above the silver crater in the foreground amid a sea of colored lights and a flood of music at the electric light and power exhibit. Spectators watch from a circular platform during the display.

duce an electro-chemical reaction between pieces of copper and zinc, thus charging a simple galvanic cell that supplies current for the machine.

In the house of thunder, better known as Steinmetz Hall, a new wonder has been added to the thundering show of last year. Visitors will be astounded to see a wire vaporize in front of their eyes to produce a cascade of light that tumbles to the ground. This may also sound phony, but if you don't believe it, go see for yourself. General Electric engineers succeed in vaporizing the wire with the aid of 10,000,000-volt lightning generators. Various conductors are used in the experiment and the vaporized wire disappears in a shower of light falling much like a waterfall.

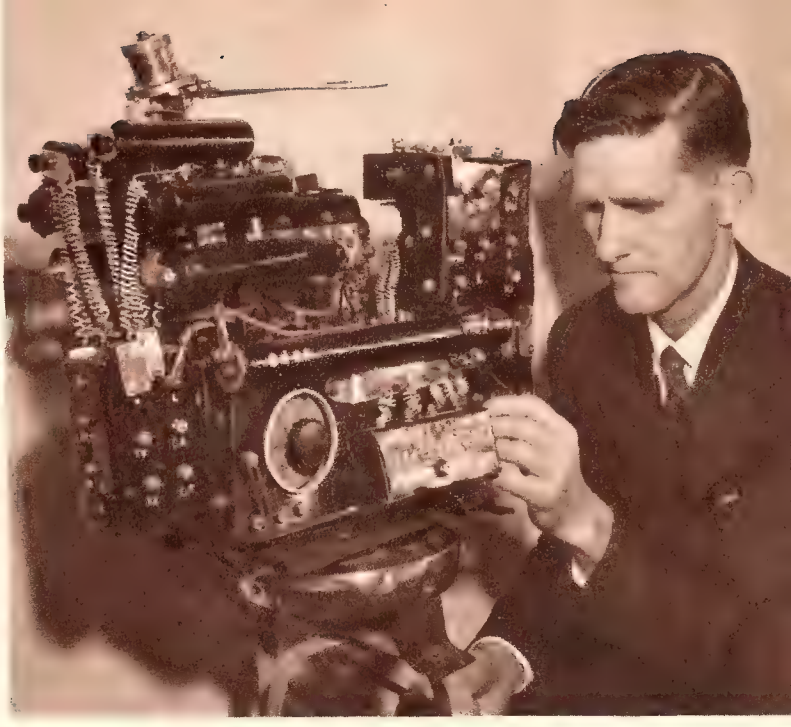
But the real feature of the 1940 Fair, if its popularity of last year is any indication, is the animated Futurama. This entertaining exhibit that thrilled millions of visitors, has been redesigned with animated automobiles and trains roaring across highways and railroad beds of the future. These animated vehicles traverse the 36,000 square feet of the Futurama, running through mountains and valleys, farm and industrial centers, with lightning speed.

This is the symbol of the world of the future. Once inside the Fair gate, it's free. The biggest, the best, the most entertaining and mystifying show on earth.



At left, above and at right are three views of Elektro, the mechanical robot that walks and smokes like a man. In full dress he appears quite imposing but he has no defense against members of the female sex and he is shown above after having lost his head to one. Stripped of his outer covering, he is shown to be all gears and machinery. Here's the mechanism that enables the robot to move his left leg as he walks, dragging the right leg behind him.

Our artist shows how Luther Shipman's machine might react to two different odors, while at the right, Shipman is shown as he lovingly tinkers with his complicated brain-child which holds no less than ninety-three separate batteries!



This Gadget Smells!

LUTHER W. SHIPMAN of Hendersonville, North Carolina, has invented an "Odor Wave Machine" and, frankly, it smells.

The "Smelling Machine" looks to the eye like a combination sewing machine, typewriter, radio, four-cylinder motor cycle engine and a conglomeration of various other but indescribable objects. The machine is twelve inches wide, eighteen inches high and two feet in length and weighs exactly seventeen pounds. A series of twisted wires connect with intricate looking dials and small round cylinders which are claimed to be batteries. Two needles measuring approximately eight inches in length are used as indicators and point in the direction of the object to be located.

The "Smelling Machine" contains ninety-three batteries and Shipman alleges that each battery is attuned to a different item. One battery contains raccoon scent, another contains gold scent and so on, *ad infinitum*. Located at one side of the contraption is a dial, supposed to be a mileage indicator. Another dial is the directional needle while other dials tune in the item that is to be located. Thus, if buried gold is to be located, the set is tuned to the battery charged with the scent of gold with the aid of the dial and the directional indicator points in the direction of the nearest gold and the distance indicator will read the distance.

Shipman will not divulge the secret of his smelling machine nor the process he uses to charge the batteries. He says that he gets the scent of deer, for instance, by locating a deer track and incorporating the spoor of the deer in his battery. To find a valuable diamond lost from a ring, he went into a jewelry store and borrowed both a cut and an uncut diamond. Although, he tried to conceal his actions, he was seen to take from his pocket a small square of some material that looked suspiciously like a cigaret paper and rub the diamonds on this substance before leaving the jeweler. He then returned to his home on the outskirts of Hendersonville and made his "Diamond Battery." Although, no definite proof is available, it is claimed that he found the ring, a $400 one, in a short time.

The principle of the "Smelling Machine" is logical. There are five senses in humans: touch, taste, smell, sight and hearing. The sense of hearing has been incorporated into a machine that receives sound from remote

[*Continued on page* 123]

Cut Yourself a Chord

The first layer of cake is about to be fitted over the music box, which is covered with a paper cup. Note the hole which has been stamped out of the cake layer to accommodate the box.

by Ken Maloney

"BIRTHDAY cake for man 73 years old. Have man sitting at desk smoking big cigar, saying 'I am the boss. Ouch, my leg!' Musical number: 'Who's Afraid of The Big Bad Wolf.'"

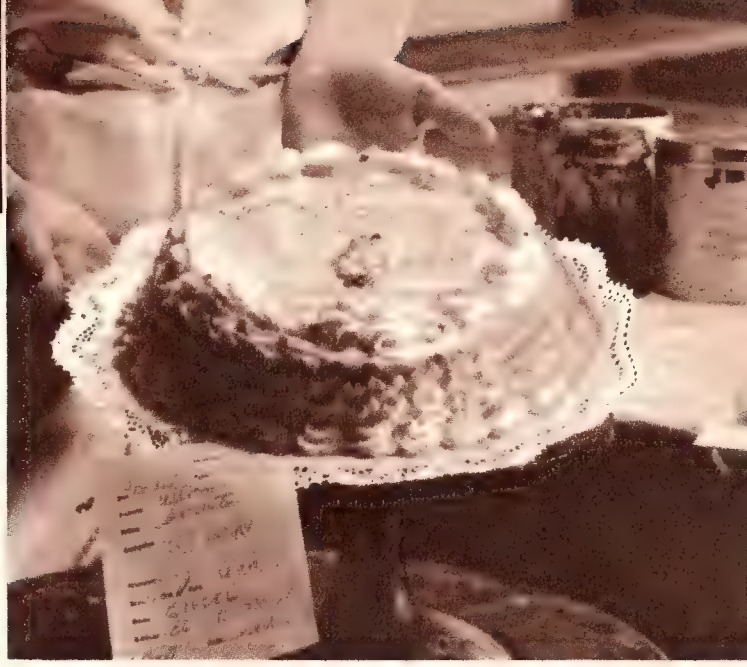
This information is typical of what has been given on the more than 10,000 order blanks on file at Cartoon Cake Enterprises, in Brooklyn, New York. It is the general outline for one of the 5,000 "Cartoon Cake" and "Musicake" masterpieces that Carl Segren, 26-year-old founder and head of Cartoon Cake Enterprises has turned out in the past year alone.

A "Musicake" is a "Cartoon Cake" set to music. Both trade names are registered. "Cartoon Cake" was first introduced in October, 1937. Almost a year later the inclusion, in a "Cartoon Cake," of a Swiss musical box that would play when the cake was cut, saw the beginning of the novel and better known "Musicake."

Carl Segren, cake cartoonist extraordinary and inventor of the "Musicake," puts a plug of cake over the "orchestra pit."

Since then "Musicakes" have been sent, by parcel post and express, in attractive and protective transparent boxes throughout the United States and Canada; to Cuba, London, Norway and Sweden. Orders and inquiries have been received in several foreign lan-

# of Cake



The finished masterpiece, ready to burst forth with "For He's A Jolly Good Fellow" when the recipient cuts the first slice.

guages. An inquiry addressed "Carl Segren, Baker, U. S. A.," recently came from South Africa.

At 2:30 one afternoon an official of Eastern Air Lines placed an order for a somewhat elaborate "Musicake." By 3 o'clock a messenger had left the bakery to deliver it at Eastern's Manhattan office. A plane out of Newark at 4:00 carried it to Washington, from whence another plane bore it to New Orleans, in good time for the special function at 11 P. M. for which it was intended.

Much of Carl's considerable business is of this short order type. A host or hostess, seeking to add an unusual note to party arrangements, will wire or phone at the last minute for a "Musicake."

Carl doesn't mind. There are always fresh, undecorated "layers" available and it requires but twenty minutes, at most, to prepare the final product. But a great deal of time must be given to answering the countless questions of most potential buyers, despite the fact that "Musicake" has been widely publicized.

"If I buy two cakes, must there be a musical box in each? Can't you fix it so both cakes will give music from just one box?" This question has been asked by a hostess who wished to fill two cakes with one song and avoid payment of a deposit of $1.50 on the smaller and $2.50 on the larger musical boxes. A refund of $1.00 and $2.00, respectively, is given if the box is returned.

"Can I get 'Believe Me If All Those Endearing Young Charms,'" it may be asked. Often, too, someone will hum a little known number and expect a Segren employee to identify it.

Any one of 40 songs may be had at once and many others, including native and folk tunes, can be secured on six weeks' notice. The musical units are imported by Thorens, Inc. Since registration of the name "Musicake" the importers are obliged to pay a royalty to Carl on every box sold to a baker for use in a cake.

Ridiculous as it may seem, one question frequently asked is whether the musical box is baked into the cake and if it will affect its flavor.

The box is two inches square by one inch in height. The mechanism, protected by a removable metal cover, is ages old. It consists of a drum spiked with teeth of various sizes that trip musical forks of 18, 22 or 28 notes. A coiled spring, key wound, sets the drum revolving when the fly wheel is released.

The unit, mounted on a thin plywood base, is fastened to the rim of a cardboard plate with two carpet tacks. A hole is punched in the plate to allow insertion of the winding key from underneath. From the lever controlling the fly wheel a piece of number 40 cotton thread runs to the right to a point about four inches away and on the rim of the

[*Continued on page* 122]

The Highest Pressure Yet

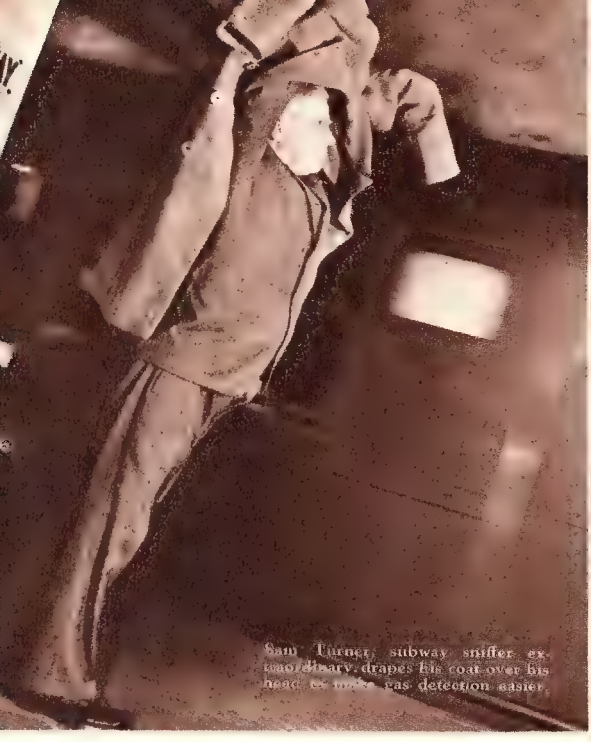
DR. ROY GORANSON, shown with his high pressure machine, the "cascade bomb." At a recent meeting of scientists at the Carnegie Institution's Geophysical Laboratory, the apparatus produced a pressure of three million pounds per square inch, the greatest man-made pressure known. Physicists hope for new discoveries with its aid.

Decibelling The Cat

IN GENEVA, SWITZERLAND, the current rationing of food made the mouse a major public enemy. As a result, cats have been equipped with amplifying earphone sets like the one shown so that even if the mice come on tiptoes, the felines can hear them walking.

New Engine Timer Mounted On Propeller

TO SIMPLIFY the timing of airplane motors, Murray A. Kahn has developed this easily operated device. It is marked off in degrees and equipped with a pointer for setting. Designed to fit on any propeller, it will greatly help the mechanic who handles a variety of machines. A great deal of time can be saved by this novel innovation through the elimination of difficult rotation checking.



Sam Turner, subway sniffer extraordinary, drapes his coat over his head to make gas detection easier.

Sometimes the subway sniffers stand on the platforms between the cars to get a better whiff of the tunnel atmosphere. Below: Tricks of the trade include extra-careful sniffing as the train enters the station, stirring up considerable wind currents. Here, Sam Turner demonstrates the proper fashion for getting a snootful of subway ozone.

Paid To Be NOSEY!

THE better-publicized beaks of history belong to Cyrano de Bergerac, Schnozzle Durante and Pinocchio, but four noses in New York's subways, truly worthier of fame, toil in modest obscurity, constantly on the alert for the safety of millions of subway riders. These four noses belong to four gentlemen employed by the Consolidated Edison Company of New York, as "subway sniffers" —John Flynn, James Regan, James McCarthy and Sam Turner.

Working in shifts, they spend their days and nights hopping from one subway station to another with olfactory nerves twitching for a sign of a gas leak. The slightest whiff of one and they phone Consolidated for an emergency crew to make immediate repairs.

Very rarely do they locate a gas leak, for Consolidated takes extraordinary precautions, but they must be maintained as an extra safeguard. Throughout the year, they ride thousands of subway miles, hopping off at each station for a snoutful of subway ozone.

These men have been engaged in sniffing tours for from ten to twenty years, during which time many an odor has gone under their nose bridges. Tricks of the trade include extra-careful sniffing as a train roars into the station, stirring up considerable air currents

[*Continued on page* 125]

MARS Plays

Turning factories into farmyards and hiding hangars under haystacks is all part of the day's work to the camouflieurs, those hard-working experts who rally to the cry of "Now you see it and now you don't!"

A detachment of Massachusetts National Guardsmen are using white sheets as camouflage during winter exercises.

by Herbert Clark

TIME was when the science of military camouflage was a simple one. The Greeks, for instance, tricked the Trojans and conquered Troy with a wooden horse in the earliest recorded use of material deception against an enemy.

Even today camouflage has a sugar-coating of what seems sheer horse-play. A Southern chemist recently offered the God of War a paint which he claims renders objects invisible at 100 feet, and an American illusionist has a gadget to hide a dreadnaught at 200 yards. This magician says his trick is not done with mirrors, but other details are still secret. Of the paint, it is known that the base is graphite and that civilian observers

HIDE And SEEK!

Not a junk heap, as even a low-flying enemy flyer might suppose, but one of Uncle Sam's finest tanks ingeniously concealed. "If you can't hide it, make it look like something else!" is the motto of the camoufleur.

reported a plane coated with the stuff couldn't be seen after it had climbed above the church steeple. For the rest, either trick may be another Greek horse—or a gag.

There is also competition from outright jesters. Bea Lillie has re-decorated her estate near London, with the front door done to resemble a palm tree. The musical-comedy star explains by saying "This'll confuse 'em. They'll think they're over Africa." "They," of course, are pilots of German bombing planes.

Greek, chemist, magician and comedienne all make the subject

The Japanese anti-aircraft gunners below are so well camouflaged that they look like moving bushes as they fire their well-camouflaged guns.

A log cabin in the forest? That's what it looks like, but on the opposite page you see what it becomes at the sound of enemy planes. At the left, a British soldier does sentry duty, framed in the arch of a draped net which is camouflaging an airplane.

sound like a joke. But the most obvious gag of the lot reveals the deadly seriousness of the problem and illustrates the way modern war affects everyday life. Miss Lillie's estate, a factory, or fishing boat have as much military importance as bombing plane, infantry division, or warship, since life behind the lines is as vital to modern war as are the fighting units themselves.

That fact has doubled the problem of the camoufleur, the specialist in hiding targets. He has all his former military work and today must also conceal behind-lines objectives.

The military phase of camouflage has the dual purpose of providing false targets and hiding real ones.

The first problem is solved by sandbagging a ditch, for instance, thrusting logs of various sizes through loopholes, and placing dummy figures here

The roof of the cabin has been removed in a few seconds and an anti-aircraft gun is ready for action!

and there. To the enemy this will seem a manned trench. Or, since gunfire burns grass, light oval patches painted on the ground at the edge of a thicket will suggest the presence of a concealed battery. I saw that used frequently and to good purpose in Spain during the recent civil war. The Chinese provide a classic "decoy" example in a fake airfield with papier-mache planes and hangars of light wood and cloth. Erected outside Canton, that "target" was bombed time after time by Japanese planes, wasting tons of explosives.

Concealment takes many forms, from the white suits Finnish troops wore in the snow, black hoods used for night scouting expeditions and ordinary khaki uniforms to the use of paint on mobile units and the hiding of artillery. The principle used is the simple one of protective coloration as seen in nature. Troops—and polar bears—are white against snow. Night raiders—and bats—are black. A zebra on an African veldt or a soldier or tank in a French forest are colored to blend with surroundings. The light breasts of birds neutralize shadows and "fade" them into the ground, so tanks and guns are painted dark above, light below. The upper surfaces of planes match ground colors, the underparts are silver-blue, which also serves to hide them in the sky on daylight flights. On night trips the underparts are blackened against ground observation.

Guns are special problems, but old tricks still work. They may be hidden in forests, with a burlap screen and greenery over them, or concealed in a haystack or a building (the roof sliding off quickly when the gun goes into action) or in a pile of junk and rusty

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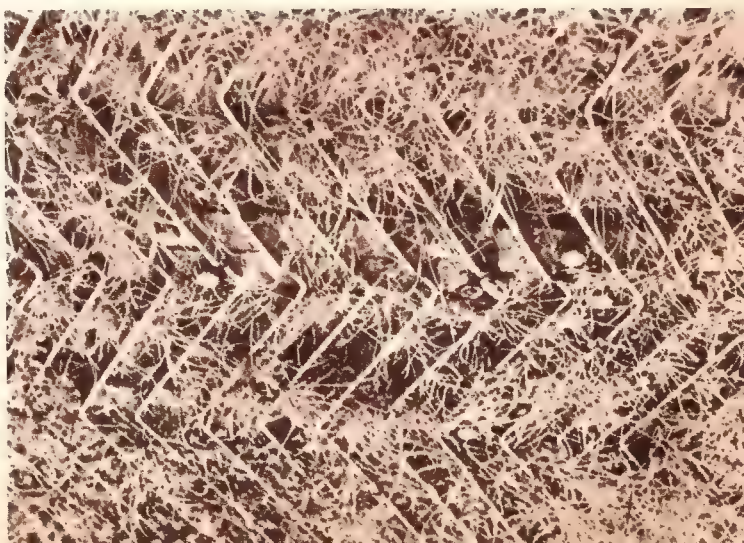


It may look like nothing at all, but it's a closeup of the steel network over the runways on a secret British air base in northern France. The steel prevents plane wheels from being bogged and grass forms an effective camouflage.

Vest-Pocket Radio Will Aid Police

WE DON'T know what Harry Rowe is saying into the microphone, but it must be pretty startling from the interested look on his friend's face. They are testing a miniature two-way radio which weighs only nine ounces and can be carried handily in a vest pocket. The entire mechanism of two tubes is housed in a case three by four inches. The device was designed chiefly for police use.

This Will Make The Planes Pipe Down!

INVENTORS are always working on means to silence the roar of an airplane's motor, and here Eddy Latulippe, of Montreal, Canada, points out the installation of a new and radical airplane "exhaust silencer" which he has invented. The weight of the entire installation for a 50 to 1,000 h.p. motor ranges from eight to twenty-three pounds. A back-lash "trap-door" opens automatically in case of back fire so that the muffler is "blow-out" proof.

Half-Pint Plow Helps England Fight

THE gentlemen watching the pretty young women's efforts seem quite pleased with the action of the "Rototiller," which is the name of the individual plow that she is guiding. Said to be ideal for plowing up small plots of ground, these "Rototillers" are being hired out to local residents by many English town councils as an aid to the British "Dig for Victory" campaign, which encourages the raising of vegetables in every available spot.

Board Enables Blind To Play Checkers

LOSS of his sight in an accident has not made Laurel Shugars, of Kalamazoo, Michigan, forego his favorite diversion—checkers. He has built a checker-board that enables him to play as well as anyone with complete sight. One player uses square checkers, the other, round. The squares of the board are indented, and notches carved in the square edges enable the sightless player to detect just where the "men" are on the board.

Giving The Sun Some Competition

THE painter in the picture at the right has just applied a coat of laquer to a door panel and is hastening the drying process by applying radiant heat energy created by a battery of nine new reflector-type drying lamps. Use of the lamps was found to cut drying time to a small fraction of that required by simple exposure to the air. These lamps enable a housewife to dry the family washing quickly and economically, cook food, heat a room or an entire house in cold weather.

Here's A Model That Cost $16,000!

THIS one-tenth scale replica of the new Boeing Stratoliner is valued at $16,000, and is one of the most complete wind tunnel models ever built. Among the many features of the model are its electrically-powered propellers and its complete system of internally-operated flight controls, which help to give the model a high degree of accuracy in amassing research data.

Five "Minute Men" assigned to the Pacific coast receive instructions as to just which highways they are to safeguard with stations. Below: Two North Carolina "Minute Men" stand ready for action, qualified to take care of bruises, bumps and broken bones.

"Minute Men" of The Highways

DOWN the road came the big sedan, weaving crazily, swinging the house trailer behind it perilously from side to side. Sensing catastrophe, the people in the roadside gas station snatched up their kits and rushed out just as the trailer overturned and crashed into a parked car directly beside the Red Cross sign near by. A moment later, E. W. Power was administering first aid to the dazed accident victims while his wife telephoned the doctor.

Every day, somewhere along the nation's highways, a similar roadside drama is enacted by one of the 13,500 "traffic minute men" who stand always ready to give their help to the victims of auto crashes. Restaurant men, garage mechanics, barbers, grocers—people from every walk of life—are the volunteers who operate the network of more than 3,000 emergency first aid stations spotted at points where traffic hazards are great and hospitals or ambulances are far away. Every man has been given the standard course of training by American Red Cross instruc-

tors and each station is provided with a 24-unit kit, including a stretcher and a half-ring Thomas splint to immobilize fractures, and is prepared to render emergency treatment to the injured until the doctor comes.

At a typical station run by a woman who operates a little restaurant on the Yellowstone road in Idaho, hardly a day passes during the summer season without a call for help. Last year she treated 146 persons for injuries ranging from a broken collar bone, to bee stings.

Extending the service to the open road are 2,600 men whose jobs keep them traveling all the time—truck fleet drivers, police prowl-car patrolmen, highway maintenance men, public utility workers. Members of the roving squadrons also have received Red Cross training, carry kits, and give their services without pay to the injured on the nation's highways.

With the idea that every Red Cross sign marking a station shall save at least one life,

[*Continued on page* 125]

Members of a line crew of the New England Telephone and Telegraph Company practice their bandage technique on a fellow linesman.

Above: A gas station attendant, trained in Red Cross first aid, carries one of the stretchers that each station is equipped with. There are more than 3,000 emergency first aid stations now in operation.

Red Cross training was put into practice by Westchester County police, in New York, when a 73-year-old woman broke both legs in a head-on crash against a stone embankment.

The Odds On Death Are 6-to-1!

"READY?" asks the pilot.

"Ready," says Jim Williams, his voice muffled because of the knife clenched between his teeth.

"Okay," the pilot says.

"Okay," echoes Jim, and then is gone, hurtling over and over through the air, twisting down toward a swiftly approaching earth. Suddenly a white 'chute flares forth and his hurtling descent is checked . . . but not for long! Taking the knife from between his teeth, Jim reaches up and slices the cords that hold the 'chute, and down he plummets again. Four more times he goes through this same procedure, until the sixth and last 'chute, the one that brings him safely to earth.

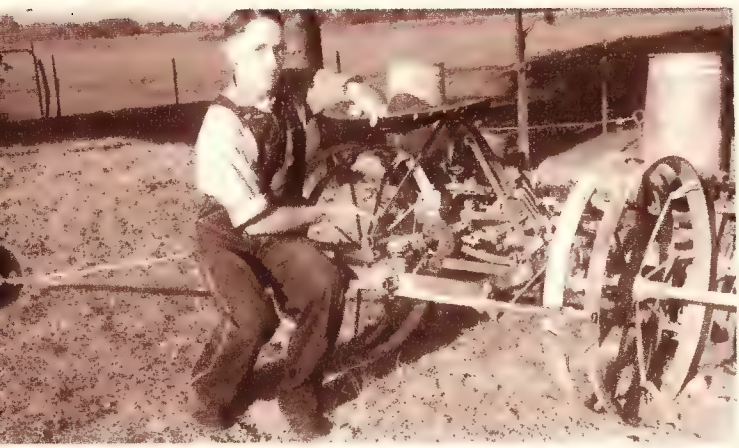
Below, Jim Williams makes his way across the airfield to the waiting plane. He has attached five parachutes to his body, and the sixth one will be fastened to the plane's cabin step.

A photographic record of Jim Williams' famous death-defying jump shows how he uses all of his parachutes in succession. The fifth parachute has just opened, and he has one more to go.

Inside the cabin of the plane, Williams is ready to leap. He holds in his teeth the knife with which he will cut himself loose from each of his parachutes on the drop to earth.

A Rolling Home Gathers No Moss

CLIFFORD GILLILAND, 24-year-old construction worker, of Ortley, S. D., is shown filling the water supply tank of his traveling home. Although not suited to large scale entertaining, this simple trailer has all the comforts of home as far as utility is concerned. It was built in a blacksmith shop from a $5 Essex body and an old Model T frame.



The Farmer Makes Machinery Count

FARMER HOWARD L. MORRIS obligingly takes an uncomfortable seat in order to point out his recently developed gadget. The apparatus, when attached to a corn planting machine, automatically figures out how many acres have been planted and notifies Mr. Morris of the progress made. The device was adapted from a wheat drill with the aid of a strap iron gear.

It's In The Bag—And It's Comfortable

THE young lady above and to the right is demonstrating a new folding hammock and awning. An outstanding advantage of this device is the fact that it can be carried in a golf club bag—to the right spot, on moonlight nights.

Harry Atwood—Pioneer

If plastic planes revolutionize the airplane industry as many predict, the credit will belong almost wholly to this one man, whose inventiveness and tireless efforts have paved the way!

Above is a plastic plane of impregnated spruce plywood and phenol plastic. At the right, Harry Atwood inspects the model of a plastic plane now under construction, which is designed for stratosphere flights. The present war in Europe has spurred interest in the future of plastic planes.

ONE blustery afternoon, back in 1920, Harry Atwood, holder of a score of "firsts" in early-day aviation, pioneer pilot and successful inventor, took off, a U. S. Navy observer in the cockpit with him, and flew the world's first wood-plastic aircraft, a strange-appearing seaplane, over the white-capped waters of Pimlico Sound, on the North Carolina coast. A few minutes later, a group of Navy officers, watching the test from the shore, thought they had witnessed the world's first plastic plane tragedy.

Through a half-gale of wind, the contraption fought its way, now climbing high, now dipping so close to the waves that the wind-driven spume beat into the faces of the flyers.

"Guess she can take it, eh?" Atwood yelled into the ear of his companion, as he put the nose of the ship down, starting a power dive from which he expected to level off a few feet above the water. Down swooped the seaplane from an altitude of less than a thousand feet.

Not much room for such a dive, but Atwood was sure he could bring the craft out of it, all right. They plunged toward the waves, the whole structure quivering, every brace wire singing.

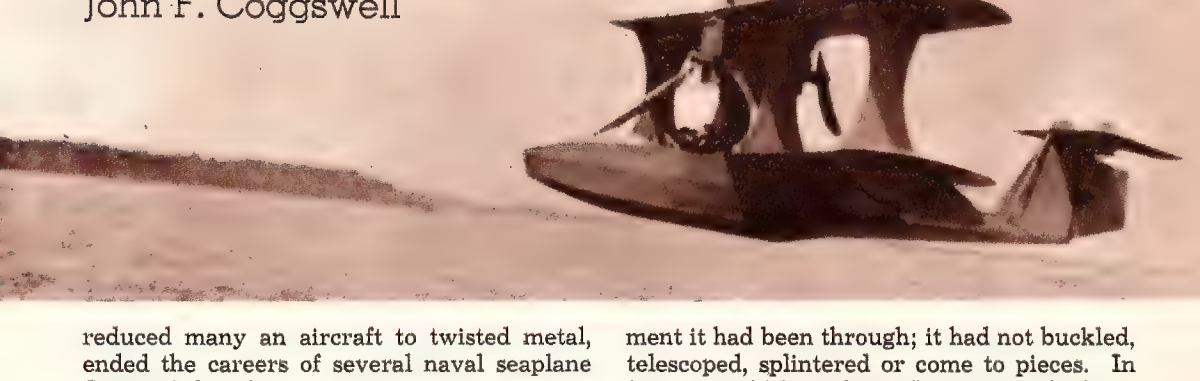
Just as the pilot was about to flatten out to start another climb, a giant roller, feet higher than those running before it, came roaring in from the open sea, its green wall tipped with foam. The catapulting plane, throttle wide open, smacked the crest of the big wave with a smack that was heard on the shore.

The craft bounced a full hundred feet into the air, turned halfway over, refused to take the gun and level out, side-slipped, hurtled nose first into the tossing waters at a 45-degree angle, went clean under.

The horrified naval men, watching from the shore, scrambled into a launch, put off to the rescue, certain that Atwood and the observer would be drowned in the sunken plane, if they weren't already dead, killed by the fuselage telescoping or buckling under stress of the terrific blows, a disaster that had

# of Plastic Planes

by
John F. Coggswell



reduced many an aircraft to twisted metal, ended the careers of several naval seaplane flyers of that day.

Hardly were the lines cast off and the launch started, though, before the rescue party saw that the seaplane had come to the surface, lay there bobbing on the waves, a bit logy from a cockpit and tail full of sea water, but still floating.

Aside from a thorough wetting, too, the occupants were none the worse for the experience, leaving out a few bruises from being hurled into the front bulkhead. Indeed, Atwood was located floundering about in the water that filled the fuselage, already busily engaged in examining the structure, ascertaining what damage, if any, it had sustained in the crash.

The seaplane towed ashore, he was at his inspection job again, even before changing his sodden clothes. He found that the fuselage showed no single sign of the rough treatment it had been through; it had not buckled, telescoped, splintered or come to pieces. In fact, it could have been flown again had not there been indications of disintegration of the binding material that held together the laminated sheets of plywood of which fuselage and wings were shaped.

There was the only item in the construction of that novel seaplane, built at Smithfield, N. C., in a few weeks, under observation of Navy flyers, with which Harry Atwood was not satisfied. Cure that, he was convinced, and the aviation world would find in aircraft constructed of wood sheets and a binding material—the type of construction that has now been dubbed "plastic"—lighter, cheaper, more durable planes than had ever

At the top of the page is Harry Atwood's first plastic seaplane, leaving the waters of Pimlico Sound, in 1920. At the right, Harry Atwood stands before the plane, whose initial test encouraged him in his belief in the value of plastics in airplanes.

Harry Atwood watches the weaving of ribbons of wood into a broad woven sheet which will be covered with sheets of thermoplastic and put under pressure in heated metal molds.

Below: The inventor looks over a test cylinder of the wood plastic construction. This cylinder, one-sixteenth of an inch thick, withstood interior pressure of over 75 pounds to the square inch.

been built. Also, he was certain that such planes could be built in a fraction of the time required in established methods.

The one weak factor in the structure of the seaplane, which Massachusetts Institute of Technology aeronautical engineers have since decided was the father of the so-called "plastic" planes that are attracting so much attention today, was that binding material.

In that day, Atwood had small range of choice of materials with which to stick his plywood sheets together. After considerable experimenting, he decided upon blood glue as the best adhesive. It held the wood together, all right, until it became well wet.

"After it started to let go, that queer-looking seaplane literally melted to pieces before my eyes," he relates.

Indeed, and the quest for a binder that would hold wood together in heat, cold and dampness, proved to be a long one for Harry Atwood. In fact, for all the experimenting he did, he never did find it. But chemical research engineers, working in their laboratories, did, called the new materials "plastics," gave them to industry which has transformed the stuff into a thousand-and-one everyday articles.

But whether his blood glue had stuck or not, the inventor wasn't at all discouraged. He had turned out the seaplane in about one-tenth the man hours usually consumed in building any kind of plane. Its weight was rather less than half that of any seaplane of like size that had ever been turned out. And the contraption had flown and flown mighty well.

And it was strong. Harry Atwood was convinced that no metal plane ever built could have taken that smack on the wave-crest, that plunge into the waters of Pimlico Sound, without being reduced to shattered, twisted, sunken wreckage.

He took his problems back to his laboratory, high on a mountainside, near Greenfield, New Hampshire. Off and on, during the next ten years, leaving off only for work that would supply funds for the job that he considered his big one, he sought the binder that would

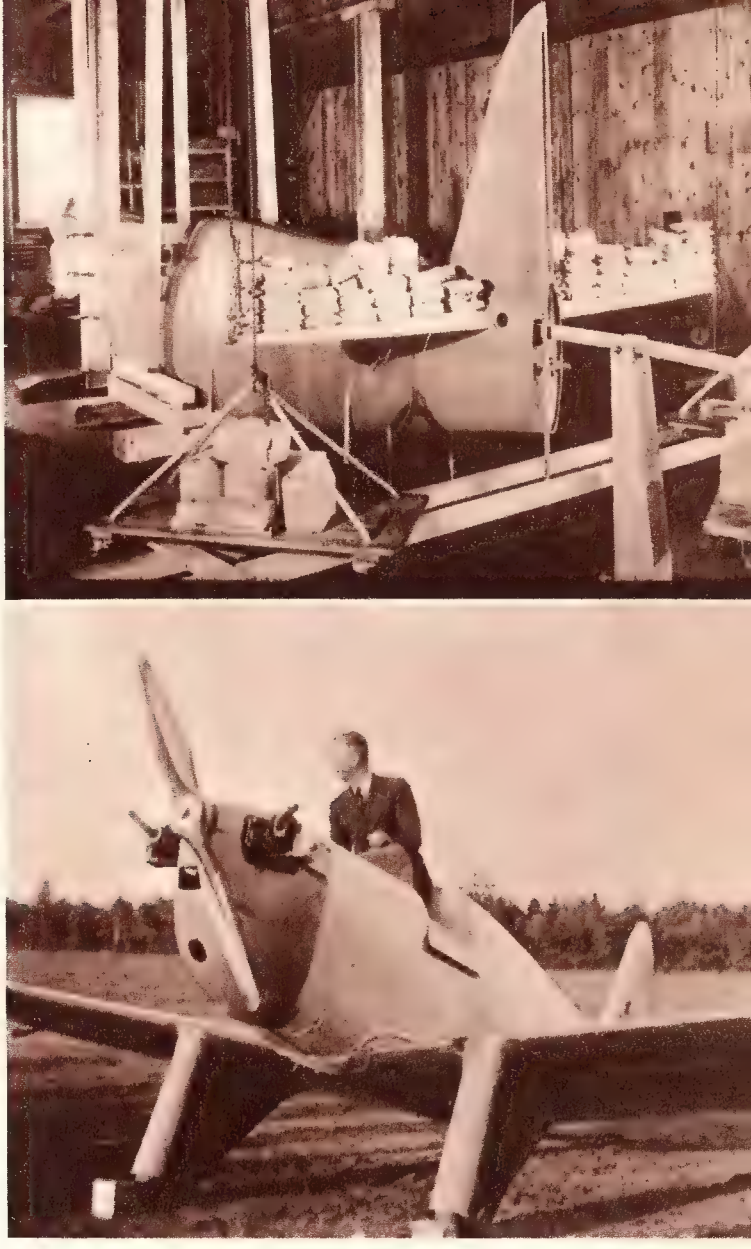
hold laminated wood together in any kind of weather.

Then science gave a waiting world and Harry Atwood, the new material "plastics." The inventor proceeded to combine this ultra-modern product of the research laboratory, with one of the oldest arts known to mankind, to produce his second plastic plane, one that would stand up under any conditions.

While seeking his binder, he had been wondering whether there wasn't some method of handling wood that would be superior to plywood in plane construction. One day, he caught himself gazing intently at an ordinary woven basket, wondering what about it was drawing his interest.

Suddenly, it dawned upon him that he was looking at one of the world's engineering marvels. Here were rotary-cut strips of wood only a little thicker than heavy paper; they could be broken by a child's fingers. The whole basket could be torn apart without any great effort.

Yet that basket; so light that, empty, it could be lifted by one finger, would carry a hundred pounds weight without sagging. Upturned, a heavy man could sit upon it without crushing it. There was a real strength-for-weight wonder of the ages; one that was easy to put together, built of one of the cheapest raw materials in the world, so cheap that a few cents would buy it.



The upper picture shows the tail of the fuselage of one of Harry Atwood's plastic planes undergoing tests for stresses at the Massachusetts Institute of Technology. The lower picture shows Clarence Chamberlain after a flight in one of Atwood's plastic planes.

Atwood got long ribbons of wood into his laboratory, interlaced them in a flat basket-weave, until they became a broad woven sheet. Over the woven structure he laid a sheet of the then new thermoplastic—a sheet plastic that can be softened by high temperature, but which after heating and cooling develops a hardness almost that of glass.

He placed his combination of wood and thermoplastic into a heated form, subjected it to high pressure. When he took it out, he had something that he was sure was right. The plastic had filled the interstices between the wood strips, welded them into a strong, cohesive whole. The finished material was smooth as glass on both sides, could be bent almost double without cracking.

Under the searing flame of a blow torch, it would char but not blaze. A jet of live steam played on it for hours had no effect whatever. The pressure that the stuff,

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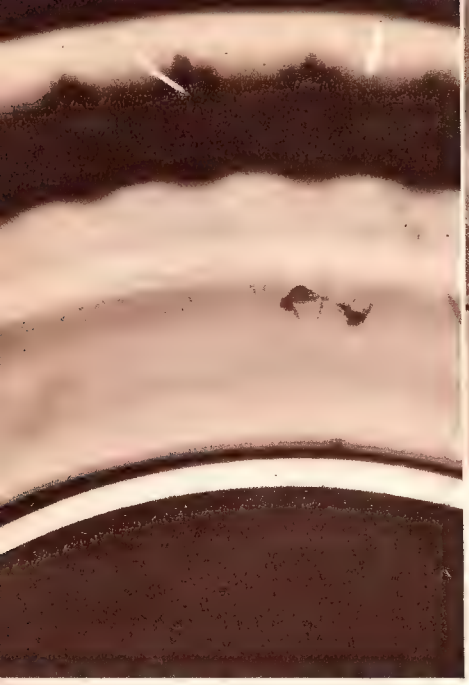
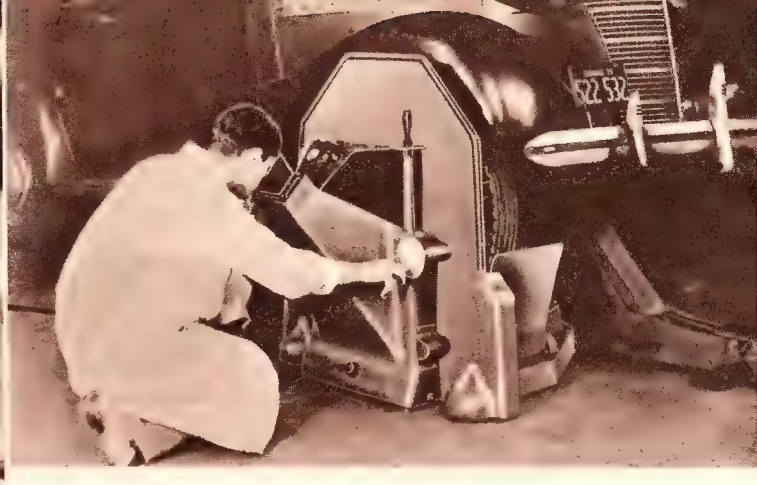


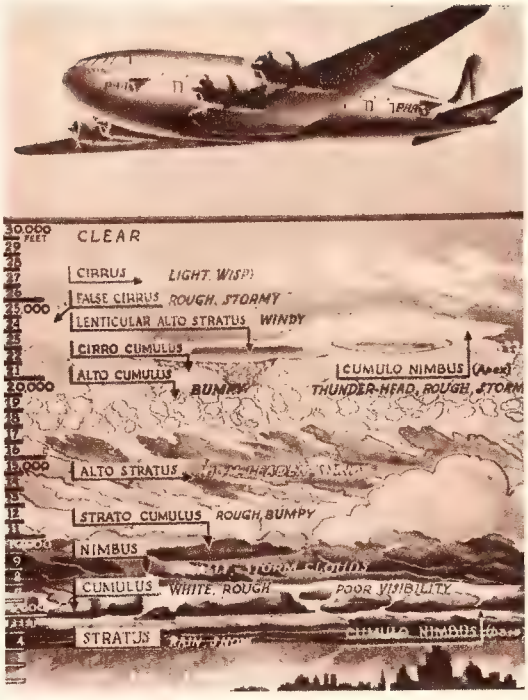


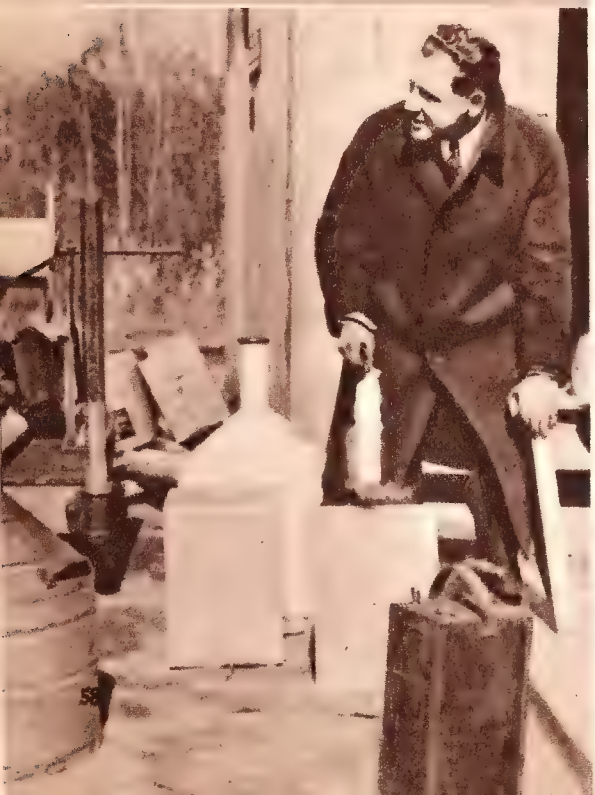
Changing A Flat Before It Happens

THE "Tire-o-Scope" that looks into your tires and foretells your troubles. Operating like an X-ray machine, this newly perfected apparatus shows tire flaws and imbedded foreign bodies like the nail at the left. Above, a service station attendant checks a tire.

It's Always Fair Weather

THE new Strato-clipper, "Flying Cloud" will carry its passengers nearly six miles above the earth. The picture at the right illustrates the various cloud layers and their accompanying weather conditions. This new type ship is specially designed to assure comfort at high altitudes.





World's Deadliest Explosive

KNOWN as "Glimite," a new liquid oxygen and carbon explosive is capable of spreading death and destruction over a radius of 1,000 feet. Its inventor, Lester Barlow, is shown lifting a charge of it into an experimental bomb.

Sculptor Carries A Torch

REFUSING to be a chiseler, Floyd Nichols does his sculpture with an acetylene torch. Among his creations, a number of which are to be exhibited in a New York art gallery, is the "Stage Coach Attack," above. Mr. Nichols was a welder until ten years ago, when he discovered his artistic talent, which is now paying him dividends.

Sport Without Effort

A DEVICE that sets up duck-pins, keeps score, returns the ball, and generally does everything but criticize the technique of the bowler has been introduced, complete with the alley. Another gadget, for golfers, tees up 70 balls automatically. All that is necessary to complete this labor-saving trend is apparatus to bowl and drive golf balls.

Fruit Farmers See A

The infra-red lights, as shown in this picture, are strung between the trees and turned on and off thermostatically. Below is the master switch box of a ten-acre grove which has been protected for two years by infra-red illumination. The infra-red light is also believed to stimulate the growth of the trees.

INFRA-RED light controlled by a robot switch is now being used to protect Southern California orange groves from frost. Instead of being awakened in the dead of night for the unpleasant job of lighting smudge pots, ranchers using the new heating method sleep peacefully while a thermostat turns on hundreds of infra-red lamps when the temperature gets dangerously low, and turns them off again when the thermometer rises.

Moreover, the infra-red illumination stimulates the trees. The use of infra-red heating also solves the old problem of smudge smoke which often causes great annoyance and much property damage to communities in citrus growing regions.

Believe it or not, the infra-red method of orchard heating which may revolutionize citrus growing is the result of a chance incident in which a partially burned out spotlight was turned on a thermometer. One night several years ago when Quinter E. Bashore, rancher-electrician of Covina, California, was trying to see a thermometer inside the window of a service station, he called for aid from a passing police car. The car's spotlight was partially burned out, giving it a yellow tinge and increasing its infra-red quality.

New Light

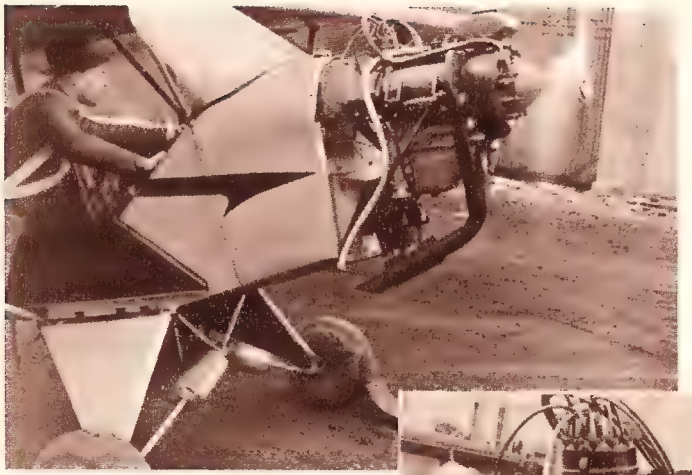
Shown among the lemons which they have protected from frost for two years are three infra-red lamps. The globes, standard therapeutic infra-red lamps, vary from 7,500 to 10,000 angstrom units.

Although the rays from the spotlight had to pass through the window glass and part way across the room, they caused the thermometer to rise perceptibly.

If infra-red would heat a thermometer, it would also heat trees. That gave Bashore his idea. After four years of experimentation he

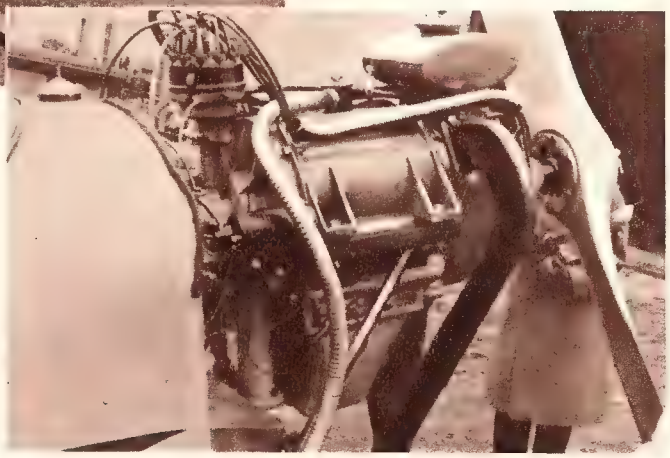
[*Continued on page* 130]

Changing infra-red globes used in the new type of citrus orchard heating is a simple matter. Sockets and reflectors are strung between the trees, as shown in this picture. Below: One light is used for every four trees, or forty lights to an acre. With the lights turned on, it is sufficiently light to permit night work.



Wobble-Plate Engine For Lightplanes

BARNEY OLDFIELD'S brother, Lee, designed this new and revolutionary "wobble plate" airplane engine. Weighing only 130 pounds, it develops 50 h. p. It is known as the "Dynamotor." It can be completely overhauled in one hour and forty minutes.



Save Your Pants For A Rainy Day

THIS raincoat has pants. You can stand on the street corner in the rain, while the traffic speeds through the nearby puddles—and still you won't get wet. It's easy to get in and out of the pants. Simply zip them open down the sides, and there you are.

This Makes It Twice As Easy

THE "Tri-dimensional Traffic Pattern." Devised by Captain H. C. Claiborne, this little gadget somehow helps Flying Cadets perfect their formation flying. Miniature airplanes are used to illustrate the various maneuvers.

Proving It's A Plastic Age

MOTHER Nature, who has to dodder around for years to preserve a fly in amber, is proved a slow-poke by Dr. Charles E. Sando in a novel exhibition at the Franklin Institute of Philadelphia. Scientists have long sought to preserve biological specimens in their true form and color. Today, after all other methods have failed for one reason or another, a United States biochemist using Plexiglass, an acrylic resin, has solved the problem. The Franklin Institute is exhibiting his preservations of plant and biological specimens, including vegetables, fruits, grains, flowers, and insects, imbedded in transparent, crystal-clear blocks of acrylic resin. A boon to both science and education has come into practical use, by following nature's suggestions.

The collection includes the skeleton of a human hand, a tarantula spider, a rattlesnake's head, showing the poison fangs, two frogs; a spray of wheat, a pre-historic ear of Peruvian corn (Fourth Century B. C.) exhumed from the grave of an Inca warrior, a double boll of Texas cotton, various brain corals and shells, a beautifully iridescent South American butterfly. Dr. Charles E.

[*Continued on page* 130]

At the left, above, is a tarantula spider, and at the right are two bullfrogs, all imbedded in acrylic resin.

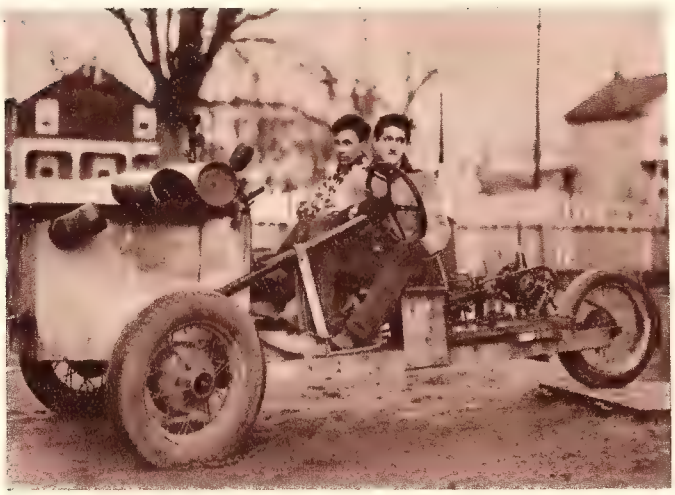
A rattlesnake's head preserved in a block of crystal-clear Plexiglass is a bit of important historical evidence, of invaluable aid to science and education. Right: Another exhibit in the preservation show at the Franklin Institute of Philadelphia, is this skeleton of a human hand.

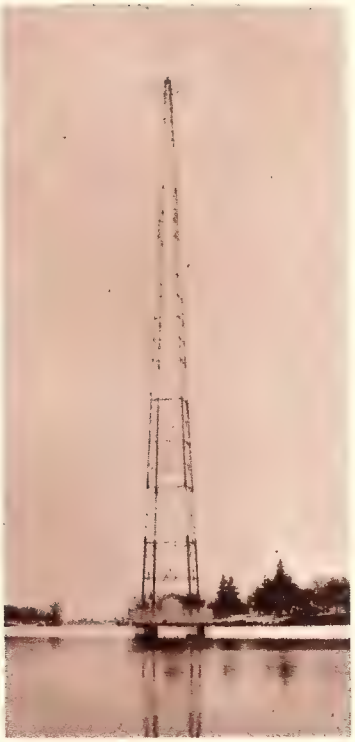
New "Iron Lung" Resembles Armor

DR. F. H. TERHAAR, at left, demonstrates the new portable "iron lung" which he recently developed. Dr. George Scherer is wearing the new lung, which resembles a piece of medieval armor. Rubber gaskets around the openings of the jacket make it airtight. A San Francisco infantile paralysis patient will soon make a flight from his native city to Honolulu wearing the new lung.

But Where's The Cowcatcher?

RESIDENTS of Jamesburg, New Jersey, have been astonished recently at the sight of this odd-looking car "scorching" through town with a stream of smoke behind. Built by three local boys, two of them shown here, the car is a steam automobile with a power plant including two house radiators and a discarded oven as a firebox.





Here's a Chance For Bathroom Baritones!

PROBABLY the only radio broadcasting tower in the world that is located in the middle of a lake is this lonely-looking 225-foot tower for the Michigan State Police post at Paw Paw, Michigan.

You're RIGHT—That's WRONG!

Here are 25 statements, some of them true, the others false. The trick is to separate the *true* statements from the *false* ones—and it isn't as easy as it looks! Use a pen or pencil and check the correct box under each statement and see how you make out! After you've given yourself the test, try it out on friends and other members of the family and compare scores, They'll enjoy it and so will you.

Are you ready? Let's go!

1. A black cat named Twinkletoe crossed the Atlantic non-stop, in a bombing plane, about a year after the Armistice.
   True ☐ False ☐

2. There are many law-abiding citizens in the United States who are not allowed to obtain a patent.
   True ☐ False ☐

3. If the late Thomas Edison, famous American inventor, had gained a pound in weight for every patent he was granted, he would have weighed more than a full grown horse.
   True ☐ False ☐

4. All submarines in the United States Navy are named after fish.
   True ☐ False ☐

5. A samphire is a brilliant yellow stone found in the wilds of Mongolia, and valued at more than twelve million dollars a pound.
   True ☐ False ☐

6. A hen that always lays its eggs with the light side facing upwards is called a Heaviside layer.
   True ☐ False ☐

7. The Canary Islands were so named because of the large number of dogs found there.
   True ☐ False ☐

8. Steel wool was originally obtainable only by shearing a hydraulic ram.
   True ☐ False ☐

9. Mendel's Law is not a part of the Constitution of the United States.
   True ☐ False ☐

10. Simon Lake is widely known as the body of water in which the first submarine was given its test runs.
    True ☐ False ☐

11. An N. A. C. A. Cowling is a thoroughly inspected and certified young male cow, guaranteed by Federal food examiners to be free from rabies.
    True ☐ False ☐

12. Polar bears have bristles on their feet to keep them from skidding on the ice.
    True ☐ False ☐

13. Groups of two dozen five-kilowatt dynamos, as arranged in manufacturing concerns, are called "dynasties."
    True ☐ False ☐

14. A car with a front wheel drive uses the front wheels for steering also, like any other car.
    True ☐ False ☐

15. The spiral striped poles seen in front of barber shops originally symbolized a bandage.
    True ☐ False ☐

16. A tarpan is not a fish, but a small wild horse, noted for its hardiness.
    True ☐ False ☐

17. Modern fighting planes are equipped with gas tanks that will not leak even after they have been pierced by machine gun bullets.
    True ☐ False ☐

18. Stainless steel would not make a good compass needle because it is not affected by magnetism.
    True ☐ False ☐

19. A phobia is any disease that causes its victims to froth at the mouth and bite.
    True ☐ False ☐

20. The term "contact" as used by airplane pilots, originated during the war when it was customary to start the engine as soon as the pilot's trousers touched the seat.
    True ☐ False ☐

21. A prototype is a bronze engraving used by printers to reproduce detailed photographs in large numbers.
    True ☐ False ☐

22. A catatonic is a chemical that makes a reaction possible without actually taking part in the reaction.
    True ☐ False ☐

23. Liquid air, unlike most liquids, is affected noticeably by magnetism.
    True ☐ False ☐

24. Even on the great level stretches of salt in the western section of the United States, the fastest cars in the world have been unable to exceed the speed of the fastest airplane.
    True ☐ False ☐

25. Rubber got its name from the fact that it was at one time used chiefly for rubbing out errors in writing.
    True ☐ False ☐

WHAT'S YOUR SCORE?

To get your score, simply give yourself 4 points for every question you answer correctly and total the result. If your mark is above 90, you are exceptional; if it is between 80 and 90, you deserve high praise; if it's between 70 and 80, you're good; between 60 and 70, fair; and below 60—well, try again next month!

Answers will be found on page 132

Your Job! Drafting

The draftsman fills an essential place in the modern industrial world. Would you like to be one? Then read this, the sixth in MECHANIX ILLUSTRATED'S vocational article series. Test your potentialities as a draftsman with the questionnaire on page 69.

A good many draftsman were needed to create every accurate detail of this giant hotel, the new Waldorf-Astoria in New York City. Each man may well be proud of his part in the finished achievement.

by
Donald G. Cooley

TAKE a look at your shoes, your wrist watch, your necktie.

They all started as ideas in someone's mind. But before a wheel could start turning to manufacture them or a single artisan be put to work, some draftsman had to translate those ideas into the working drawings which are the universal language of industry.

Now take a look at an automobile. A few weeks ago I visited the drafting rooms of one of the big motor corporations at Detroit. Across the street machinery hummed in a vast body plant. Behind the drafting rooms stretched a gigantic as-

A man-made galaxy lights the way for the night shift at Grand Coulee dam, under construction in the state of Washington. The foundations for this tremendous project were laid, not in the muddy bed of the Columbia river, but on the clean surfaces of drafting boards.

sembly plant. I went down and watched workmen snaking chassis frames upside down onto one end of a moving line.

From overhead rails, motors came swinging into line a second or two before the frame arrived. The power plants were lowered, bolted into place. Wheels of the right color for a particular chassis came rolling down a trough—again, just a second or two before they were needed. Exactly one hour from the time it started as a stripped frame, a complete new car came rolling off the line.

If that moving line should stop it would cost the company $1,000 a minute. Nobody I talked to could remember that the line ever *had* stopped. Every bolt, every washer, every big and small piece that goes into a complex motor car, fitted exactly into place because the men in the drafting room upstairs had planned it so. You're bound to come away from a demonstration like that with a healthy respect for the draftsmen who, sitting on their high stools before broad tables, are right now turning out with infinite care the thousands of drawings which you will see in concrete form when 1941 models are announced this fall.

Shoes or neckties or automobiles—they're all the same in the language of the draftsman. Have you ever built anything from the drawings and specifications that appear in the how-to-build-it section of MECHANIX ILLUSTRATED? If so, you have been talking the language of the draftsman in a simplified, easy-to-take form. That language gets pretty complex when it starts talking about airplane motors and bridges and automobiles. That is why a skilled draftsman is likely to be a specialist in some particular field—and why he rarely has to worry about unemployment.

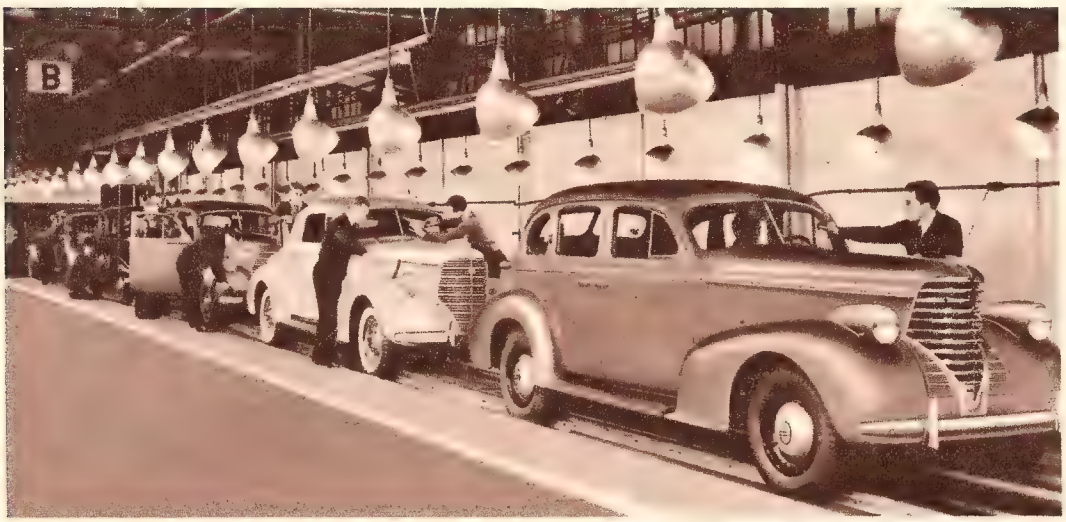
The relative ease of holding down a good-paying job, though important, is only one advantage of a skilled draftsman's career. There are other advantages—and, of course, certain

A new Pan American passenger "stratoliner" on a test flight over Mt. Rainier. Perfection on the drafting board has taken 99% of the danger out of test flying, and helped make American aviation the world's safest.

disadvantages—which you will understand better when you know just what a draftsman and designer does. So we will take you to a typical industrial drafting room and get you an imaginary job right where you are practically certain *not* to start—at the top.

The chief engineer or architect calls you into his office and turns over to you a few rough sketches. These show a product or piece of machinery or building which your organization is going to manufacture or erect. He discusses the project with you until you understand just what is wanted.

Your title may be chief draftsman or assistant engineer or designer, or you may have no title at all. Your job is to take those rough



The perfect timing of the assembly line has its inception in the drafting rooms, and were it not all worked out on paper with microscopic accuracy, delays meaning huge financial losses would be incurred. The automobile industry is one of the largest employers of draftsmen.

Test Your Qualifications for the Vocation of DRAFTSMAN

Many of these questions are not easy to answer, because they require you to take stock of personal qualities that are hard to measure—but those are the qualities that determine success as a draftsman. Take plenty of time to make your self-analysis as accurate as possible. Score 4 for each question answered "Yes" (except the first); no credit for "No" answers. The first two questions are fundamental and must be answered "Yes" for drafting success. A score of 84 or better indicates aptitude as Draftsman and Designer; a score of not less than 72, aptitude for learning the basic engineering language of mechanical drawing.

	YES	NO
Is patient, thorough, painstaking accuracy one of your outstanding characteristics? (Score 8 if outstanding, 4 if average, 0 if less than average)	.....	.....
Do you have a very strong liking for mathematics?	.....	.....
Is it easy for you to understand blueprints, diagrams, and mechanical drawings, such as appear in the workshop section of Mechanix Illustrated?	.....	.....
Can you follow a clear set of directions without getting mixed up?	.....	.....
Do you have a keen interest in natural sciences—physics, chemistry, etc?	.....	.....
Would you rather deal with objects and material things than abstractions?	.....	.....
Do you have a practical turn of mind combined with imagination (devise small improvements, inventions, see new uses for things)?	.....	.....
Is your general health good, particularly your eyesight?	.....	.....
Do you work well under supervision, take orders without "losing face"?	.....	.....
Have you an education at least equivalent to two years of high school?	.....	.....
Is it easy for you to learn from books, do "paper work"?	.....	.....
Are you neat and orderly in habits (handwritten letters not blurred or blotted, workshop tools and belongings usually in place)?	.....	.....
Do you accept responsibility readily, "take the rap" for your errors?	.....	.....
Are you able to invest two or three years' time, at small wages or none at all, learning drafting as an apprentice or in spare time study?	.....	.....
Do you like machinery and have a fair amount of mechanical ability?	.....	.....
Are you a good team worker, getting along well with people?	.....	.....
Can you visualize and think in three dimensions?	.....	.....
Do you invariably plan things in logical fashion before going ahead?	.....	.....
Would you rather take twice as long to turn out a perfect job, than to finish a piece of work only 98% perfect in half the time?	.....	.....
Do you like to work in the same room with many other people?	.....	.....
When you understand the career, opportunities and income of a draftsman, after reading this article, does it satisfy you as a life work?	.....	.....
Do you like to associate with men who are your superiors, more experienced and better established than you?	.....	.....
Do you like to work with your hands as well as your head?	.....	.....
In your opinion, are you reasonably endowed with qualities of resourcefulness, initiative, creativeness, originality, cooperativeness?	.....	.....

sketches and work them out accurately, but on a broad scale. You must figure stresses, specify materials, uncover "bugs" that may be lurking in the rough sketches. Dimensions have to be set down to the last ten-thousandth of an inch. Headwork? You bet—plenty of it. If the job is a big one you will turn part of it over to other designers who work under your direction.

Now we swiftly demote you a step in the ladder to the job of detailer. Let's say the project being worked on is a printing press for newspapers. As a detailer, you get an assignment to draw one unit of the press—an ink fountain, perhaps—in exact proportion, with exact measurements, exact specifications, exact materials specified. If you indicate a bolt hole in a certain position, that's where it will appear, and if, when the press is assembled, that bolt hole is just a little out of place so the fountain can't be fastened to the press, it's just too bad. You won't be a detailer any more.

Once more you're demoted. You're a tracer now. That, very likely, is where you'll start when you land a drafting job, so we're really down to earth now. As a tracer, you take the drawings made by detailers, stretch translucent cloth or paper over them, and make a tracing in ink. This tracing is what will be used to turn out the actual blueprints which diemakers, patternmakers, and other workmen will use in making drawings come to life.

Sounds simple, doesn't it? But let's examine the qualities you will have to have to carry out those assignments.

First, and most important, except for one other quality, is mathematics an easy dish for you? In many of the careers discussed in this series, mathematical ability is desirable. In drafting and designing, it is indispensable. If arithmetic is a bore to you, geometry a headache, logarithms an unfathomable mystery and a slide rule an instrument of torture, you'll be a miserable draftsman and will do well to drop the idea like a hot potato.

You not only need mathematical aptitude to figure stresses and strains, but you need it as proof that you have a logical, practical head on your shoulders which you have disciplined into thinking along a straight line. If you are content to remain always a tracer, then mathematics won't make very much difference to you, but you'll be effectively barred from stepping higher.

So, if you have always rated good marks in math, you have every reason to consider drafting as a career.

The San Francisco-Oakland Bay bridge is a living symbol of the miracles developed on modern drafting boards. The Administration's program of Public Works has given hope and employment to hundreds of draftsmen.

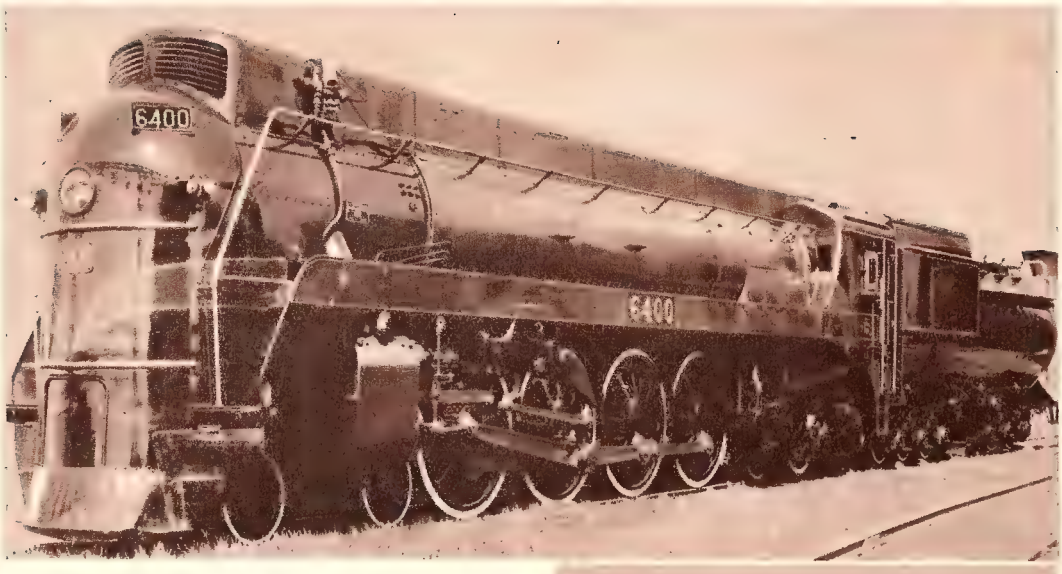
That other indispensable quality we mentioned is *painstaking accuracy*. It is so important that in the aptitude test on page 69 it entitles you to a double score. Brilliance in a drafsman is not only unnecessary but a positive liability if it tempts you to sacrifice accuracy to impetuous cleverness. A drawing that is 99% accurate is as useless as one that is completely haywire. If one of your drawings some fine day should hold up an assembly line at a cost of $1,000 a minute because you specified a ⅜-inch bolt instead of ¾, you'll be too expensive a luxury to keep on the payroll. In school 65% is a passing grade, but in drafting you flunk out on anything less than 100%. In considering any vocation, it is a good idea to remember that your boss will be a whole lot tougher than your teacher.

Maybe you have never tried to make an analysis of your character, so the aptitude test may appear a bit difficult, but if you have the stuff that makes a skilled draftsman you will be logical, objective, and practical enough

BALANCE SHEET

Advantages and Disadvantages of the Draftsman's Vocation

ASSETS	LIABILITIES
Throws you in contact with important men	Strain on eyes may be severe
Physical work is easy	Sedentary work
Job highly regarded by community	Practically requires a high school education
Not a dead end job; your work is never "buried"	Competition is keen as many engineering graduates start careers as draftsmen
Excellently adapted to spare time study, night school or correspondence	Must invest two to three years' time preparing for job
Combines headwork with handwork so you're not old at forty	Have to go where jobs are; 4 out of 5 drafting jobs are in northern area between Atlantic and Mississippi
Demand for skilled men is constant	For real success, absolutely demands mathematical aptitude and passion for accuracy
Chance to become a specialist	
Is foundation for engineering professions, basic language of industry	
Springboard to so many important positions in industry that it is impossible to list them here	



to give sound answers to every question. Ability to learn readily from books, to follow diagrams and directions intelligently, is an excellent sign in the budding draftsman, for the whole career is one of "paper work." Your school marks will be a good index here. A draftsman sits down with a problem, a set of drawing instruments, and a sheet of paper, and everything he knows has to show on that sheet of paper to be of practical benefit to anybody.

It may seem strange to you that nowhere in the test is there a question as to whether or not you like to draw. Such a liking is certainly an asset. But drafting is, fundamentally, *the language of engineering,* and given ordinary dexterity and a fair amount of mechanical ability you can be taught all you need to know.

"Do I need a good educational background to get into drafting?" is a question that is bound to occur to you. The answer is definite. You do. We are talking now about drafting and designing, not simple tracing. Two years of high school is a practical minimum. Four years is even better.

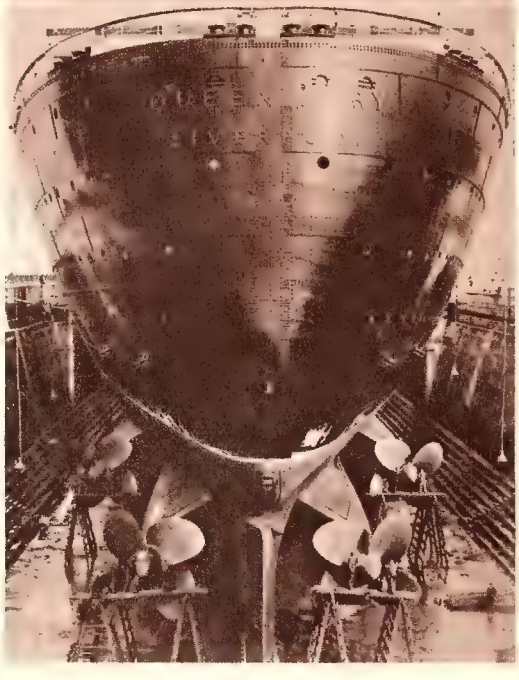
"Much of the work is on college level, and half the subjects are straight engineering," says one executive of an institution that has trained hundreds of draftsmen.

Your education can be acquired outside a high school, of course, but it must be equivalent in background. Theoretically, shop experience provides a fine background for drafting training, but actually most shop apprentices do not have engineering background and so in practice the usual start is in drafting room rather than the shop. Many tracers today are college engineering graduates, taking the first step upward. As a draftsman you will always be competing and working with men with brains.

In this field which is anything but shy in

[*Continued on page* 118]

Careful planning and thousands of drawings go into the makeup of a ship or locomotive before a single piece of metal can be cast. Creation of patterns from which parts can be made is also up to the draftsman.



Sea-Going Oil Drill In Drydock

FINDING oil under the sea is probably the next best thing to finding gold in Davey Jones' locker for the oil company operating the floating drill shown at left. Tanks in the twin-hulled barge are flooded to sink the drill over the desired spot. Drilling is accomplished through a rotary table which stands above the water's surface.

Spring Fashion For Trucks

THE upright scavenger body shown on the right is the truck manufacturers' answer to the English garbage-for-pig-feed campaign. Geared to operate mechanically, the body tips vertically, thus packing the waste more tightly. One truck load will feed plenty of pigs!

Largest Ice (Topaz Gem) Cools In American Museum

LOOKING much like a cake of ice, the largest single piece of Topaz in the world is now on display in the American Museum of History, in New York City. Discovered in Brazil, it measures 2 feet long, 2 feet wide, 18 inches high and weighs 596 pounds. Although unique, this crystal is not of gem quality.

Music In The Air

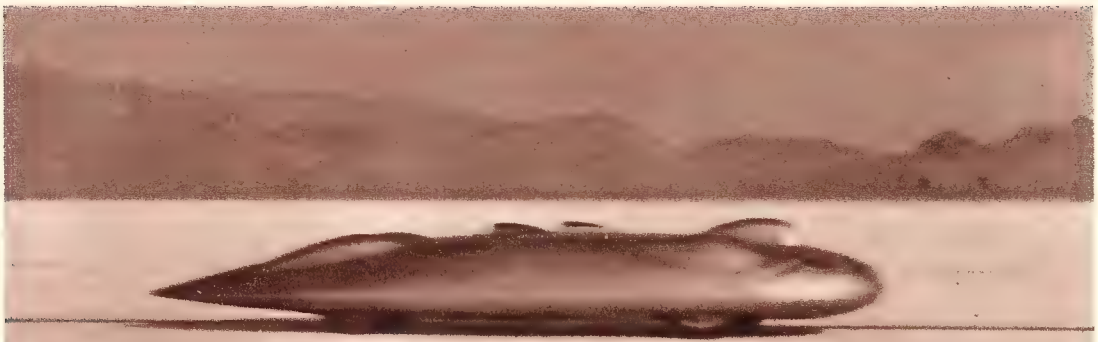
IF A pigeon flies over you playing "Sweet Adeline" don't decide to go on the wagon—it'll probably be one of George Spiegel's birds. George, a New Jersey pigeon fancier, has equipped his pigeons with unique sound devices made of reed and silk poplin mounted on an ivory tongue. The musical gadgets, imported from China, fasten to the birds' tail feathers.

New Reversible Window

A NEW YORK inventor has applied for patents on the unique double-hung reversible window shown at left. The window can be made of wood, metal or plastic and can be washed on both sides from inside the room. When the window is opened at top or bottom a concealed screen appears. The screen rolls out of sight when window is closed, allowing more light to enter than would with ordinary windows.

Machine Takes Rocks Out Of Soil

A BLESSING to Southern California citrus growers, this ingenious contraption will clean up their rock-strewn lemon groves by "sifting" the earth from the stones. Pulled through the groves by tractor, the machine scoops up the top layer of ground, dropping back the soil and carrying all rocks up a conveyor to be dumped into a truck. William Teuscher, of Claremont, California, is the inventor.



Mileage is What You

Can your car pass a gas station? You'll "fill up" less often if you take the advice given in this article. Below: Change your oil according to recommendations. Remember that the heavier the oil, the more pull on your motor with poorer lubrication.

The *Railton Red Lion*, driven by John Cobb, of England, roars across Utah's Bonneville Salt Flats for a new world record of 368.85 m.p.h.

VERY few car owners know what gas mileage they are actually getting, and most of them would be disagreeably surprised if they did. Neither is it generally understood how many factors can affect mileage. "My car is only getting around 12 miles. Can you give the carburetor a going-over while I wait?" is a typical expression of the attitude of the average car owner.

The carburetor probably is the most common gas thief, but as a matter of fact, almost anything can affect mileage, and it is usually a combination of causes. Fouled plugs, dragging brakes, faulty ignition, poor compression, under-inflated tires—these are only some of the causes of low mileage, any combination, or any one of which may take its toll from each gallon of gasoline.

The secret of mileage for any car is the perfect functioning of all its working parts. That means frequent and thorough maintenance. This has never before been so important as it is today, with closer clearances and higher engine speeds and temperatures. Finer mechanical precision has made the modern motor highly sensitive to adjustments, so that greater skill and knowledge is demanded of mechanics, and the use of scientifically designed shop equipment which leaves nothing to chance almost an essential.

That does not mean that there is nothing for the mechanically-minded owner to do.

Make it!

by J. E. Van Sant

(Maintenance Superintendent in charge of conditioning the sweepstakes winners in the last two Yosemite Economy Runs.)

Mileage depends on adjustments you can make yourself —read this and find out how!

The author, J. E. Van Sant (left), not only conditions economy winners, but also drives them. He is shown here receiving first place trophy for a Division B record of 29.19 miles per gallon, made in the 1940 run.

To a large extent the good performance of any car still depends on the owner's careful attention to adjustments which he can make himself, and his wise use of service station facilities.

In order to get rid of a thief you must first catch him stealing, and the best general practice here is by regular and frequent tune-ups. Good modern garages are equipped with instruments which quickly and accurately analyze motor troubles. It pays to employ them even if you are your own mechanic. The tune-up costs little and pays for itself many times over in added miles and prevention of future grief.

While the regular tune-up gives you certain adjustments, its chief value is in telling you what to do. A fuel ratio analysis may, for example, show that your carburetor is too rich or too lean. That indicates the carburetor. Perhaps a jet is worn or clogged by dirt, lead, or residues from the fuel, but in any case you know that the carburetor needs to be gone into. It is a good practice to clean the carburetor every 10,000 miles or so, depending on the type of gasoline used and the condition of the air cleaner. Worn parts should be replaced.

You can experiment with different sized main jets to arrive at the smallest that will give you efficient performance. In all probability you can use a smaller main jet than the standard equipment with entire satisfaction and considerable economy. They are inexpensive and easy to install. Too lean a mixture, however, is poor economy, for it not only results in less power and snap, but the automatic step-up valve opens oftener because of the lesser vacuum set up in the manifold, with consequent extra rich mixture.

Sometimes it is not the carburetor that is responsible for improper mixture. A clogged air cleaner may restrict the passage of air into the carburetor, or a leak around the intake

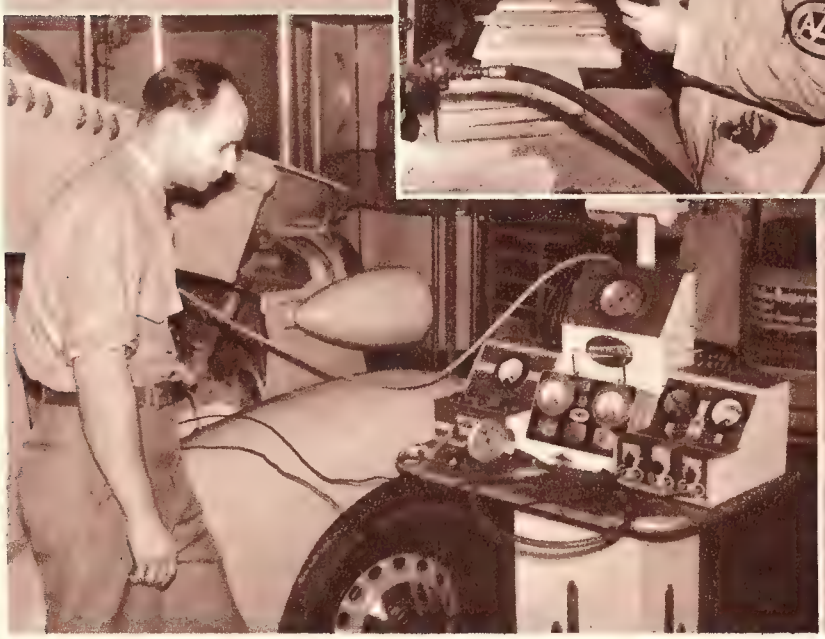
manifold may change the proportions of the mixture.

The timing of your car does not often get out of adjustment, but if it does it can be a serious handicap to power and economy. While it can be adjusted without instruments, and frequently is, it is practically impossible to do it accurately. For this vital adjustment absolute accuracy is essential, and to secure this, the neon timing light should by all means be used.

If your compression is low, your mileage is also likely to be low. Sticking valves, poor valve seats, worn rings, or tappet adjustment are the most likely causes. Correcting such faults is expensive, so even if you do your own work it is wise to make sure by a test that you really have them.

The fact that your car "uses oil" may mean

When your car is on a hoist, test the wheels for dragging brakes. You can do this at home by jacking up the wheels.



Above: Gasoline economy is greatly a matter of careful conditioning and accurate adjustments. Here expert mechanics are putting parts in peak condition for the Gilmore Economy Run.

Left: Sensitiveness to adjustments in the modern motor has so narrowed the mechanic's margin of error that instruments like this which insure accuracy are almost essential for current conditioning.

The finish of the 1940 Gilmore Yosemite Run, held yearly between Los Angeles and Yosemite National Park. The course includes city traffic, desert heat and mountain grades, and is under the supervision of the A.A.A.

that it is getting by the rings with accompanying blow-by and poor compression, but not necessarily so. A leaky gasket or a loose main bearing may be responsible, and on double diaphram fuel pumps a bad diaphram may suck oil from the crankcase into the firing chamber. This latter defect may also cause serious waste of gasoline by injecting excessive amounts into the carburetor.

Spark plugs can rob you of as much as a tenth of your gasoline. With use they become inefficient, developing a weak spark and pressure shorts. The advice to change them every 10,000 miles is based on more than sales talk. The high school boy's practical joke of shorting the plugs of his friend's jalopy by making a pencil mark down the porcelains may not show a correct sense of humor, but it does illustrate how easily the same thing can be done by grease or carbon. Keep your plugs clean. Remember that the hot spark of today burns away electrodes rapidly, making frequent adjustments advisable.

To many people a plug is a plug, but if you want the best results use only the type specified for your car by the manufacturer. The wrong type of plug or old, inefficient plugs can be blamed for much of the hard starting troubles, cause missing, and affect the whole performance of your car. I have frequently seen a new set of correct plugs add four miles a gallon to the mileage of a car.

The setting of the distributor, or "spark," is of great importance. If it is set too slow, sluggish performance results, which means that power and gasoline are being wasted. If advanced too far the result is a "ping," or fuel knock, which also means loss of power.

The proper spark setting is as far advanced as possible without ping. Adjust it so that when you accelerate quickly there will be a slight momentary knock. This is caused by the interval required for the automatic spark advance to adjust itself. The setting should vary with the type of gasoline you use, and for this reason it is best to use the same, or a closely similar type of fuel. For example,

[*Continued on page* 131]

Cutout Method

Above: Simple retouching is done with a retouching unit made from a cigar box. Right: Masking tape on the glass frames the negative.

by K. W. Strong

INASMUCH as a great deal of the "retouching" in amateur practice is of a rather simple nature, such as blocking-out, silhouetting, etc., readers will be interested in an extremely simple method of "retouching" with masking tape.

Briefly, the stunt is to place the negative between two clean glass plates and to apply masking tape (black, of course) over the areas that are to be blocked out. Curves or other irregular shapes are easily cut out by means of a sharp knife. Since the actual negative is safely under the glass, there is no danger of damage to it. The tape can be picked up and put down again repeatedly; in fact, the same pieces can be used almost indefinitely for many jobs, as they require no moistening and leave no marks or fuzz.

This method of blocking out is particularly convenient if the available enlarger happens to use a glass sandwich as the negative carrier. The holder shown in the illustration is merely slid into the enlarger the instant the work with the tape is finished. This makes for speedy manipulation—just as important to the amateur who has to go to business the next morning as to the news or commercial photographer whose time means money.

Backlighting of the negative is essential. No elaborate retouching stand is needed. Note from the illustration how a common

This is all there is to the retouching box. The film carrier is placed over the cutaway section of box.

cigar box serves the purpose. Illumination is furnished by a 7½-watt night light of the plug-in type, fitting in a round base outlet. These parts cost only a few cents in any hardware or chain store. Leave enough of the top of the box in place to form side guides for the negative holder when it is placed over the bulb. Incidentally, this box also serves admirably for real negative retouching when you feel brave enough to undertake the job.

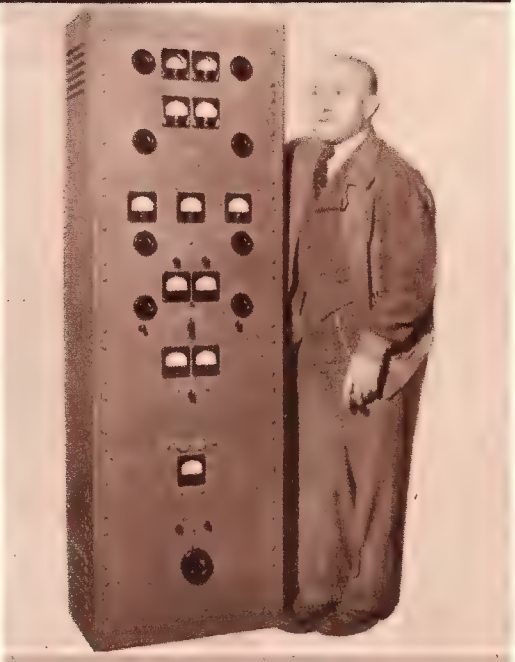
Although an ordinary penknife with a keen point is satisfactory, you will find a regular etching knife much easier to use for cutting the tape. Both camera and art stores sell one made of aluminum, with a screw chuck taking blades of various shapes, for as little as fifty cents. Don't press very hard when you cut the masking tape. The glass underneath doesn't "give" and too much

for Photo "Retouching"

pressure will tend to dull the blade. With only a little practice, you will find that the tape comes off cleanly after it has been sliced gently. If you accidentally remove too much tape from a certain area, simply press down another piece to overlap, and cut away again.

An example of the application of the method is included herewith. The original picture shows the proud builder of a very elaborate and powerful short-wave amateur radio transmitter. As a record shot it's satisfactory enough. However, observe the confused background, and the altogether unnecessary onlooker in the right background. Fifteen minutes of work with masking tape and the etching knife removed these conflicting elements. Admittedly this "retouching" is on the amateur side, but it definitely helps to concentrate the observer's attention on the apparatus and its builder.

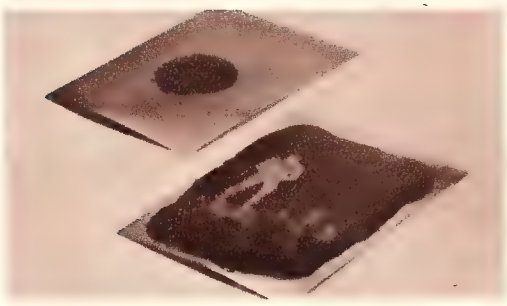
The negative shown in the illustration was 3¼ by 4¼ inches. This size is fairly easy to work on. However, the writer has used the same methods on 2¼ by 2¼-inch negatives with success.

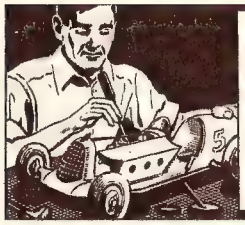


Below and above are the before and after results of the cutout method of "retouching" whereby masking tape is used instead of brush and opaque fluid.

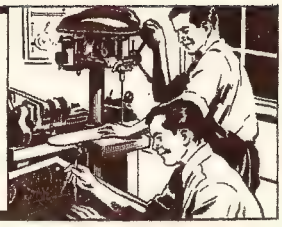
Liquid For Local Retouching

THERE'S a little trick to correct retouching. For instance, don't try retouching by dabbing a small negative area with varnish, preparatory to retouching. What happens is shown in the upper part of the photo shown below. The varnish should be applied to the entire area as shown in the lower part of the photo. Apply a few drops of the solution in the center of the film area and gently distribute it over the entire area with a tuft of cotton.





How to Build SECTION

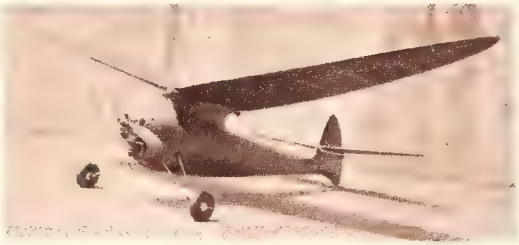


IN THIS ISSUE

Pictured here are a few of the things described in the following pages. These projects are selected for their utility, interest and ease of construction.

Gypsy, a modern strip-built canoe needing no steam bent ribs. Plans begin on page 90.

Attractive lamp and coaster set of marine design. Page 106.



MI Streamwing. 7-foot gas powered model plane with raised elliptical wing. A splendid all-around performance. See page 82.

Soft-glow night light made from glass towel rods. Turn to page 101.

A waterfall for your garden can be made with the simple pump hookup shown on page 100.

MAKE YOUR BOAT LAST LONGER

by J. A. Emmett

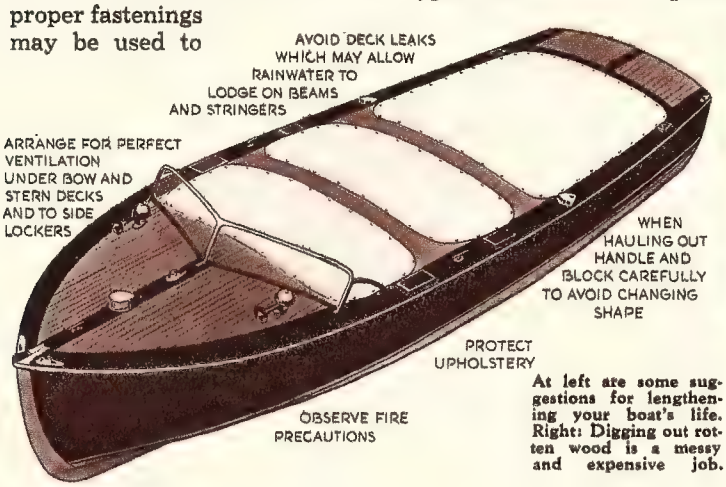
Keeping a canvas cover over the open cockpit of a boat when not in use is an important protection against rot. Salt water is anti-rot, but rain water settling in the bilge may quickly start it.

EVER since Noah built the Ark, and perhaps before that, men have been trying in different ways to lengthen out the usable life of their boats. Some of these methods have come down to us today. Pitch, for instance, is still used to prevent water lodging in odd places, salt is an age-old preventive of rot, and models of boats used by the early Egyptians show they, too, realized the necessity of ventilating closed-in places aboard.

A certain number of potential years of life are unconsciously perhaps built into every boat. Seasoned woods of correct types and proper fastenings may be used to make that life a long one, or the boat may be carelessly put together with only the thought of selling in mind. Lack of care will cause even the best-built boat to go in a comparatively short time, but attention to certain points and the gradual correcting of faults of construction has given many a poorly built boat a long and useful life. It is all up to the owner.

Thorough fitting out in the spring is very important. Correctly put on paint and varnish applied over dry and suitably prepared sur-

[*Continued on page* 111]



At left are some suggestions for lengthening your boat's life. Right: Digging out rotten wood is a messy and expensive job.

THE MI *STREAMWING*

Designed for contest or all-around flying, this modern, elliptical-winged, 7-foot gas model is easy to make and will perform beautifully.

by Larry Eisinger

THE present day automobile, boat, and even kiddie car, are all going through a new change in physical makeup. The gas model airplane, too, has been slowly going through that process called streamlining. This type of model, whose efficiency depends upon the air itself, has its own problems. We do not have engineers galore or perfectly equipped laboratories with large staffs as the various industries do, but just model builders like you and I to solve and bring to the surface the many problems encountered in gas model construction and flying.

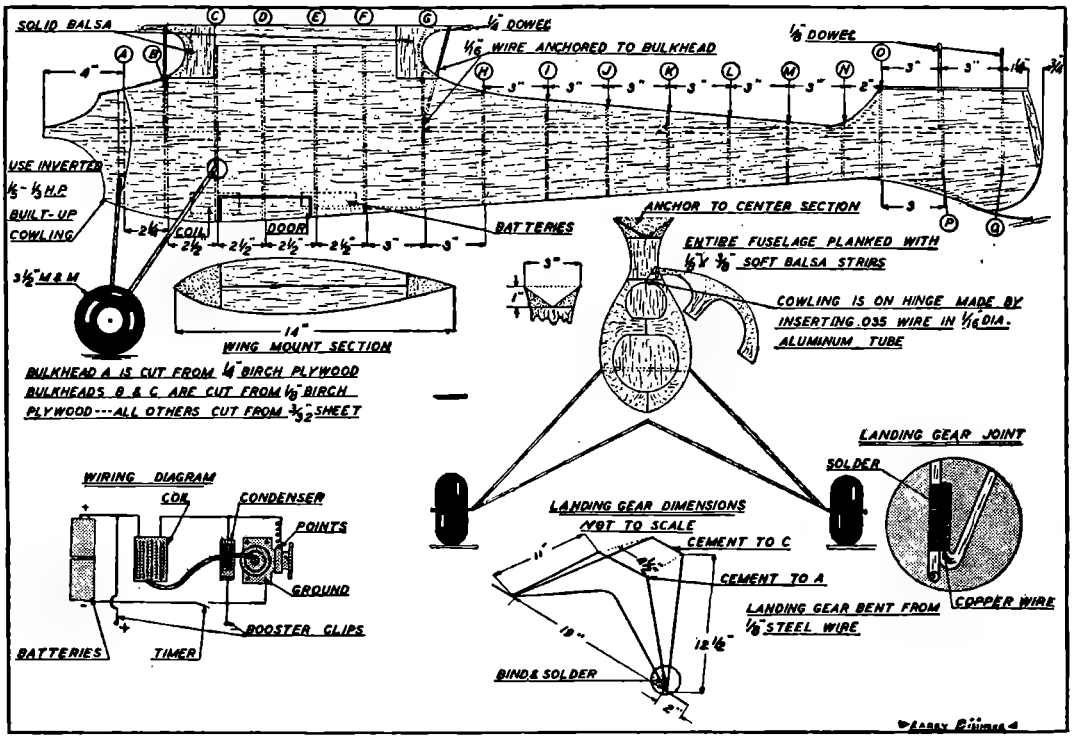
During the last year, more so than previously, the trend of the model airplane builder has been toward the sleek, ultra modern and efficient gas model. The reason lies not in the fact that everybody is becoming "streamline minded," but because of the present 20 second motor run rule. This rule has forced the model builder to change from the old style clumsy-appearing model to the sleek jobs of today that can climb in 20 seconds higher than some older models could climb in 20 minutes. For this reason the necessity for high-climb flat-glide models, the present day gas model has come to stay. Now for a few pointers on our model itself. The idea for mounting the wing above the fuselage is not new—in fact the very first model had a wing mounted above the fuselage. This location for the wing gives the model a high center of resistance, resulting

BILL OF MATERIALS

QUANTITY	SIZE	USE
1	7"x4"x¼" Birch plywood	front bulkhead
1	12"x24"x⅛" Birch plywood	bulkheads B and C
20	3/32"x3"x36" med.	bulkheads, D to Q wing ribs
1	2"x3"x18" med. balsa	wing mounts, fillets, etc.
50	⅛"x⅜"x36" soft balsa	planking, cowling
15	1/16"x3"x36" med. balsa	stabilizer, ribs, leading edge covering, etc.
25	¼"x36" med. balsa	capping strips
10	⅛"x2"x36" med. balsa	spars, etc.
7	¼" sq. x 36"	backbone, leading edge
1 pr.	3½" M. & M. air wheels	
1	½"x¾"x18" white wood	motor mounts
	⅛" diameter steel landing gear wire	

1 pint celluloid cement, 2 pints dope, 5 sheets bamboo paper (covering wing, stabilizer and rudder), 3 sheets tissue paper (covering fuselage), 1 Austin battery case, hook-up wire, solder, etc.

The raised wing mounting and inverted motor, giving a high line of thrust, make this airplane practically stall-proof.



The fuselage is built up of bulkheads spaced as shown above, then planked with strips of sheet balsa. This type of construction makes for a very light, strong body. Wiring, (see diagram) can be installed via the trap door in the bottom of the fuselage after it has been completed.

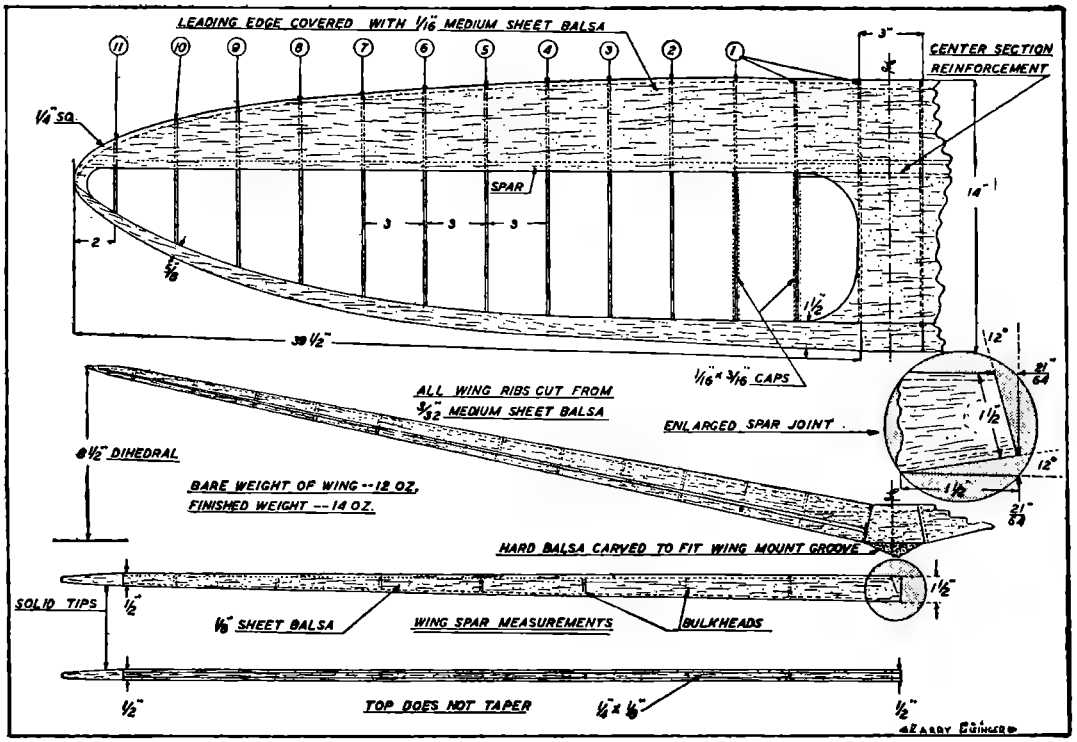
in a great tendency to nose skyward and consequently, with a good motor, the model will climb very steeply and also glide like a buzzard.

The elliptical fuselage cuts down resistance to such a degree that the model will get "up there" in a hurry—no slow circling that eats up precious seconds. A 1/8 horsepower motor will, in the *MI Streamwing,* bring you nearly as good a climb as one of 1/3 horsepower and will cause the model to glide much better because of the saving in weight. The motor, regardless of horsepower, should be inverted so the line of thrust is high as shown. This will prevent the model from stalling while under full power.

The Fuselage

The fuselage of the *Streamwing* is of elliptical shape and made up of the "backbone and bulkhead" construction. It is advisable to study the plans carefully before going into the actual work so as to achieve a clear conception of the type of construction. To begin the actual work obtain as a backbone a soft piece of 1/4-in. sq. balsa. Mark off where the various bulkheads should be situated and start cutting them out. You will note that only half of each bulkhead is drawn, so trace the other half.

Bulkhead A is cut from 1/4-in. birch plywood, while bulkheads B and C are cut from 1/8-in. birch plywood. The remaining bulkheads are cut from 3/32-in. medium sheet balsa. Bulkheads C, D and E should be hollowed out to the judgment of the builder to accommodate the batteries. After cutting out all the bulkheads complete the cementing of the four 1/4x1/8-in. stringers. These stringers are used primarily to keep the fuselage from bending out of line. The landing gear and motor mounts should then be cemented securely into place since it is practically impossible to do so after the fuselage has been completely planked. It is not absolutely necessary to complete the wiring before finishing the fuselage because this can be done at any time. As you install the wiring by working through the trapdoor, you can always get at wiring faults which, incidentally, are responsible for 90% of motor trouble. The coil is mounted through bulkhead C by cutting a hole of the correct diameter and cementing the coil securely into position. Now that the landing gear is in place the entire fuselage should be

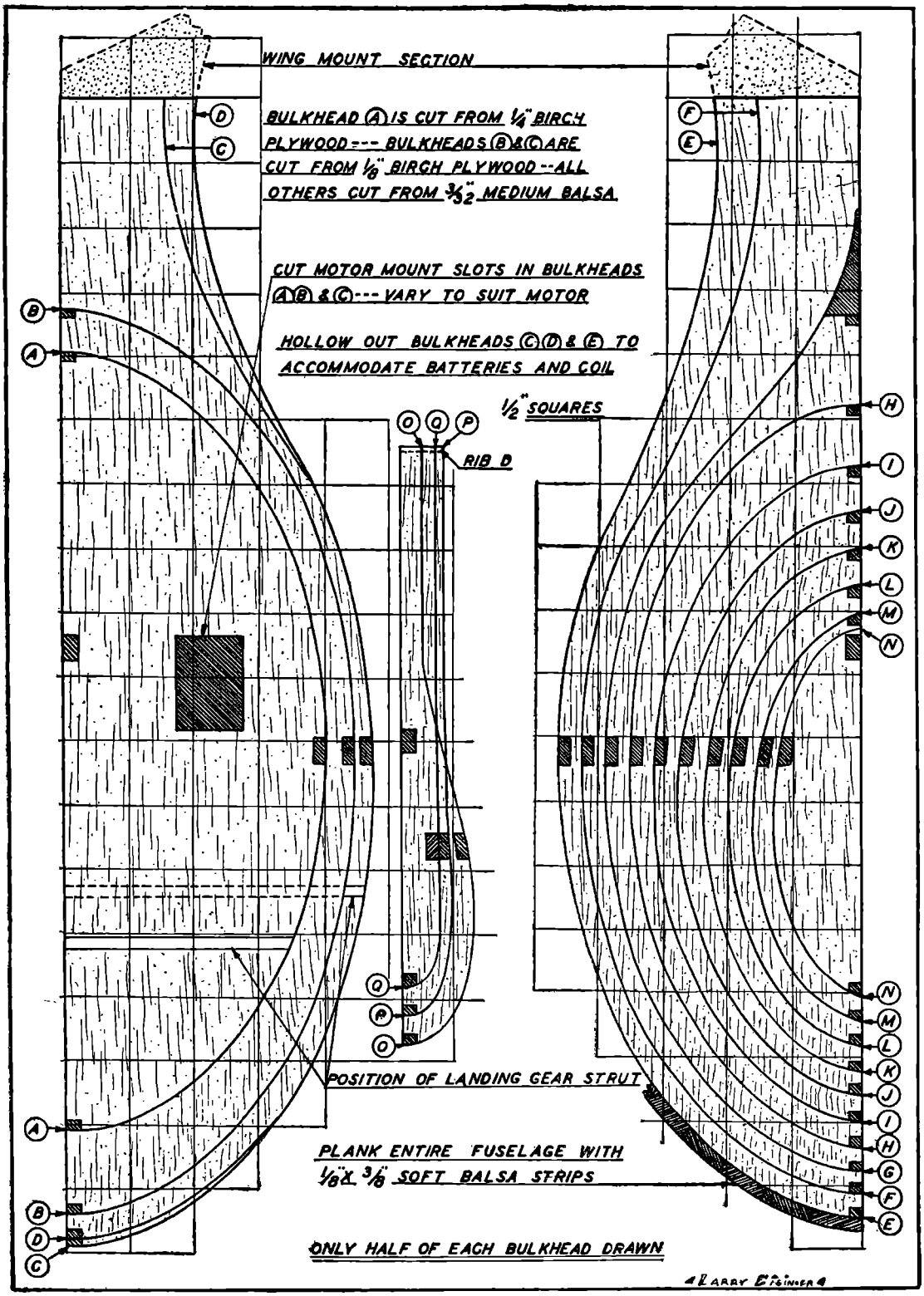


Wing dimensions and general assembly details. The elliptical shape has been found very efficient and suggested the model's name—*Streamwing*. Use celluloid cement generously during construction to insure strong joints.

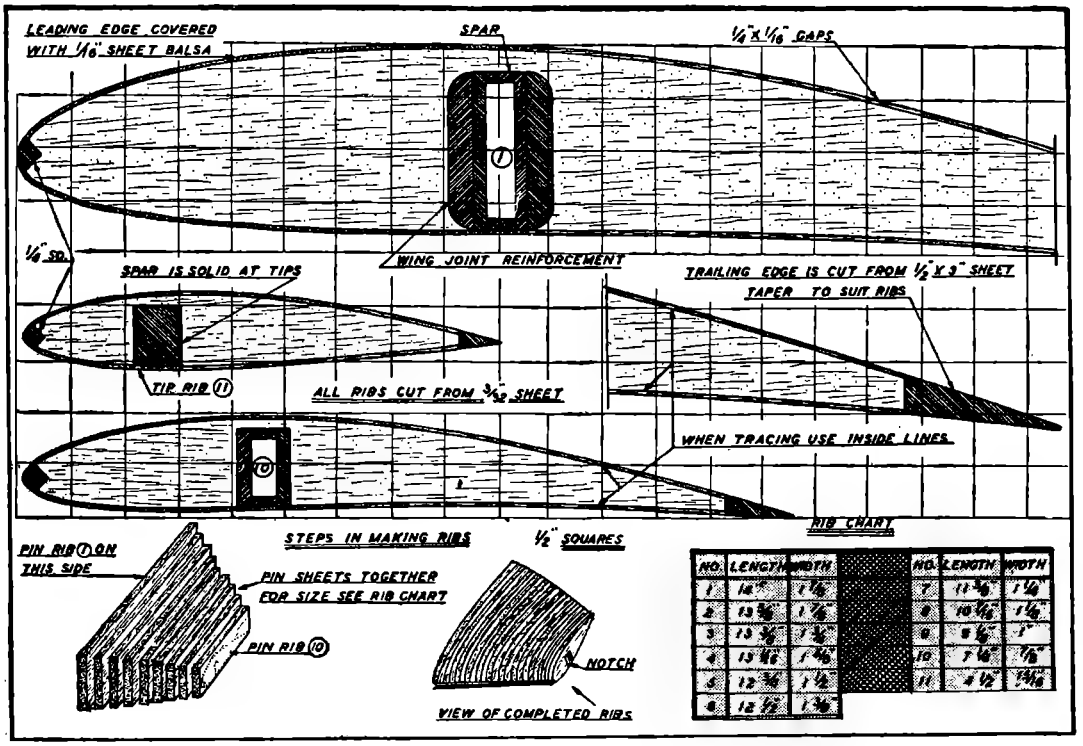
planked with 1/8x3/8-in. soft balsa and then sanded off until the fuselage itself looks as if it were solid balsa. The leading and trailing sections of the wing mount, which is covered with solid balsa, practically completes the fuselage construction. It is best to cement a rough cut of balsa in place and then carve to complete the contour of the fuselage. You will note that the wing is mounted by cutting a vee in the wing mount and then tying rubber from front to back until sufficiently sturdy. Since the tension of the rubber is very great, a piece of $\frac{1}{16}$-in. wire should be bent around the leading and trailing edges of the dowel and anchored securely to the bulkheads directly below. This will make it possible to hold the wing firmly without having the rubber tension rip out the 1/4-in. dowels. The entire fuselage should then be sanded with 00 sandpaper and given three coats of clear dope. If a smooth finish is desired, the fuselage may be covered with the ordinary tissue paper used in rubber model construction. This will cover up completely the large pores present in all balsa. A few coats of you favorite colored dope should produce a smooth, sparkling finish.

The Wing

The wing is also elliptical and consequently the ribs are not of uniform size. Since tracing and making each individual rib results in many hours of hard and tedious work, we will use a simple and efficient method of making the ribs. Notice that there are 13 ribs in each wing panel. First of all trace No. 1 and No. 11 and sand carefully. Then, with the aid of the rib chart cut out the rectangular forms from which each of the next 10 ribs will come. Put them all together side by side and hold together temporarily with pins. You now have a block made from 10 pieces of $\frac{3}{32}$-in. medium sheet balsa. On the larger end pin rib No. 1 and on the smaller end pin No. 11. Now cut and sand until the entire block is in shape of a rib with only the top and bottom leveled—because of the taper. Cut out the notches by extending the lines from rib No. 1 to rib No. 11 and take out the pins. You now have a complete set of perfectly tapering ribs with notches in their exact positions. Make six of rib No. 1 since the first three ribs are identical and make another complete set of tapered ribs by tracing the ones already cut. Notice that a slight bevel will exist but



Draw the bulkheads full-size on paper, transfer to bulkhead material, as specified, and cut each one to shape.



NO.	LENGTH	WIDTH	NO.	LENGTH	WIDTH
1	14"	1 1/4"	7	11 3/4"	1 1/4"
2	13 3/4"	1 1/4"	8	10 1/2"	1 1/4"
3	13 3/4"	1 3/4"	9	8 1/2"	1"
4	13 1/2"	1 1/2"	10	7 1/2"	7/8"
5	12 3/4"	1 1/2"	11	4 1/2"	1 1/4"
6	12 1/2"	1 1/2"			

A simple, fast method of obtaining perfectly matched and tapered wing ribs is pictured above. Make these ribs carefully, as the performance of your model when complete depends to a large extent on the accuracy of the wing surfaces.

this does not matter after the capping strips are cemented into place. When carving the ribs, bear in mind that the leading and trailing edges are curved and consequently the leading and trailing edge of the block should also be slightly curved.

The spar is built up of ⅛-in. sheet so the wing is extra strong—and light. Mark off the respective portions of the ribs and cement into place. Cementing the trailing edge is the next job. It is carved from a piece of ½x3-in. and is not bent. After one is made, duplicate to insure identical curvature on both wings and cement into place, leaving enough space for the capping strips. The leading edge, which is bent, is now cemented into position and then the entire panel is sanded down. After making a left panel and a right one join them together at the center by inserting a ¼-in. piece of sheet balsa inside each end of the hollow spars and cement securely. The necessary 8½-in. dihedral can be obtained by cutting the spar at an angle of 12 degrees. To insure extra strength, cement another piece of ¼-in. sheet to each side of the spar and bind with thread. The center joint will then be in the form of a laminated section of wood wrapped with thread.

Now that you have obtained the correct dihedral by joining the wing panels, you may sheet the leading edge with $\frac{1}{16}$-in. sheet and then cement over each rib the capping strips. After sanding with a block where sanding is needed, cover with bamboo paper and dope until a high gloss results. After the wing is covered and doped, a piece of balsa that fits snugly on the wing mount should be cemented securely to the under section of the wing at the center. This will prevent the wing from shifting under flying conditions.

Tail Surface Construction

The stabilizer is a miniature wing whose construction procedure is much like that of the wing. The ribs should first be cut from medium $\frac{1}{16}$-in. sheet balsa and cemented to the spar as shown. The leading and trailing edge, which is cut rather than bent from sheet balsa, is cemented into place. The sheet balsa covered leading edge and the cementing of the capping strips, complete the stabilizer construction. The two panels of the stabilizer are cemented to a block that fits snugly to the rudder portion of the fuselage. This, along with a few rubber bands and two ⅛-in.

dowels that are cemented to the fuselage and pass through the rudder, hold the tail surfaces into place. The rudder is made in the same manner as the stabilizer and then cemented to the center of the stabilizer section. Cover and dope.

Cowling

The cowling is not absolutely necessary since most model builders prefer to leave their motors exposed, for utmost cooling. The cowl, however, makes the model look a bit flashy yet will not affect the cooling efficiency a great deal. The method of construction is rather crude but it brings surprising results. The cowl itself is not cut from a solid block but of pieces of ⅛x⅜-in. soft balsa cemented together. Have the motor mounted in the plane and then build around it. After you have the general idea of the shape, a sharp razor and plenty of sanding will make your cowl look like one stamped from metal. Cover the outside with tissue and dope. The inside should be lined with fireproof tinfoil which usually can be found in chocolate bar wrappers. A hinge, made by inserting .035 wire inside a piece of $\frac{1}{16}$-in. O. D. aluminum tubing, will make it possible for you to get at your motor without removing the cowling.

Assembling

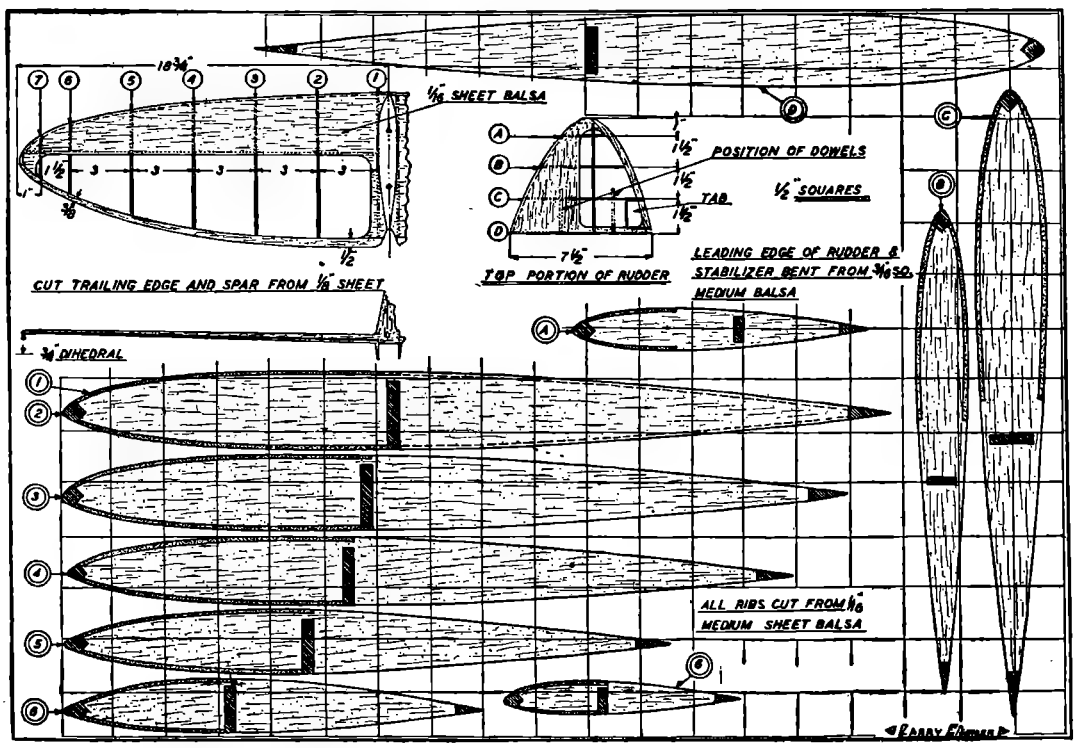
Now that we have the fuselage, wing and tail covered we may proceed to the assembling. The stabilizer has two degrees negative incidence and the wing two degrees positive. The motor is left in a perfectly neutral position since the incidence angles are measured from the thrust line. To make sure that you do have the correct amount of incidence, line the surfaces up with the use of a line parallel to the side thrust line. In reference to this line raise the trailing edge of the stabilizer ¼-in. more than the leading edge and the leading edge of the wing ½-in. more than the trailing edge. This will give you two degrees negative incidence on the stabilizer.

Flying

After you are positive your angular settings are the way described you are ready for the test hop. The balancing point, with intermediate size batteries, is about five inches back from the leading edge. Vary the position of the batteries until this balancing point is

[*Continued on page* 133]

Tail sections are made in much the same way as the wings, then assembled on the fuselage.

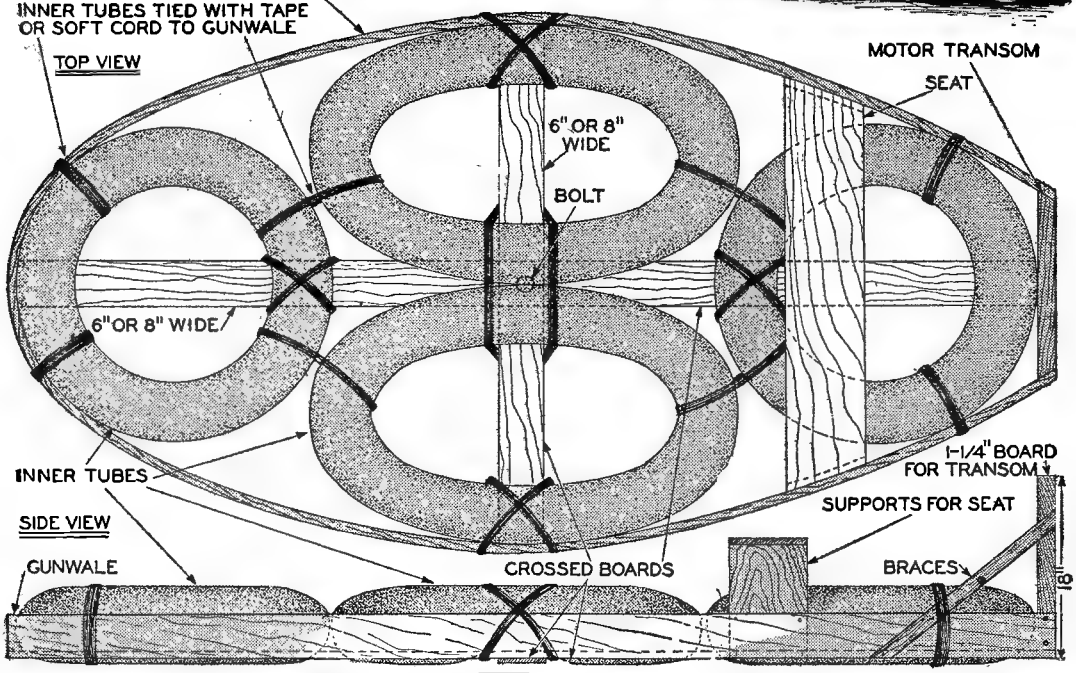


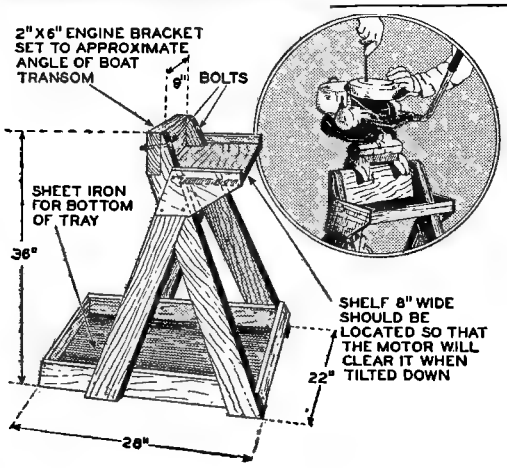
Rest On a Tired Boat

JUST think of it, driving about the lake, river or harbor with an out-board motor mounted on tires! But here is the way to make a practically unsinkable craft, one that can't be capsized and yet can be driven at fair speed with the small size outboard. It's a wet craft and you'll need your bathing-suit. It will provide heaps of fun and at little expense.

Get four large sized inner-tubes such as would be used in truck

[*Continued on page* 145]





Outboard Rack And Tray

A PORTABLE service rack, kept handy right at your landing for servicing and minor repair jobs on the outboard motor, is well worth the few hours of time and the odd scraps of lumber needed to build it. General dimensions are given for a rack that will accommodate the average motor weighing up to 40 or 50 lbs. For motors weighing over that, it is a good idea to add another 6 inches to the width.

The lower tray is decked with half-inch lumber, or better still, sheet iron, if you have it. Soft or hard wood may be used elsewhere in the construction.—*R. S. MacNeill.*

BUILD A FENCE FOR YOUR GARDEN

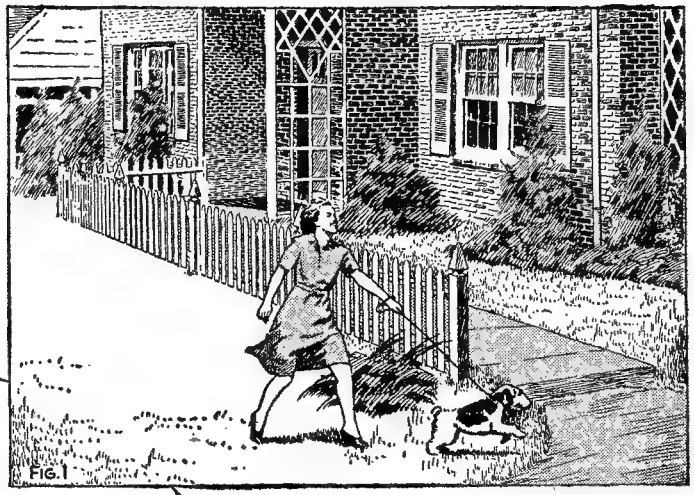


FIG. 1

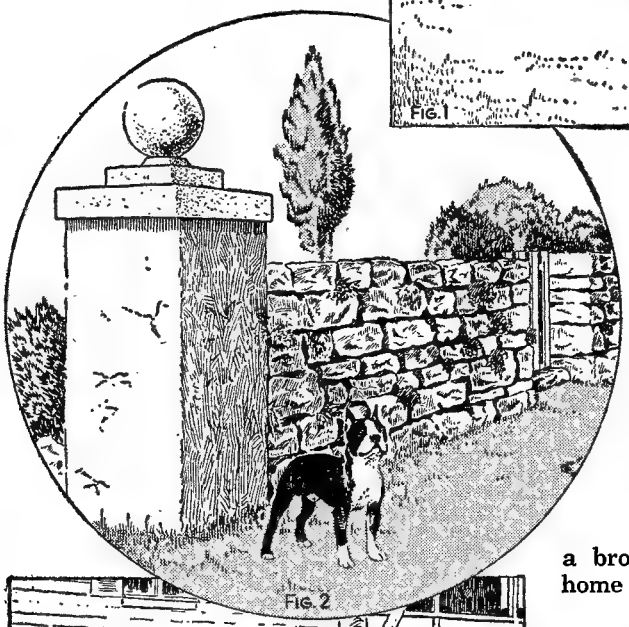


FIG. 2

by Dale Van Horn

TO DIVIDE a lot line, to more clearly define a specific plot, to hide a walk or add extra eye appeal to the premises, a fence is just the thing. Whether of wood, stone, saplings or a neat combination, the type of fence will depend somewhat upon the style of the house. Sometimes a retaining wall is so cleverly built that to the passersby, it seems to be a fence. Here are some suggestions:

Set well back from the street with a broad lawn in front, a two-story brick home has a walk leading from the front door

[*Continued on page* 146]

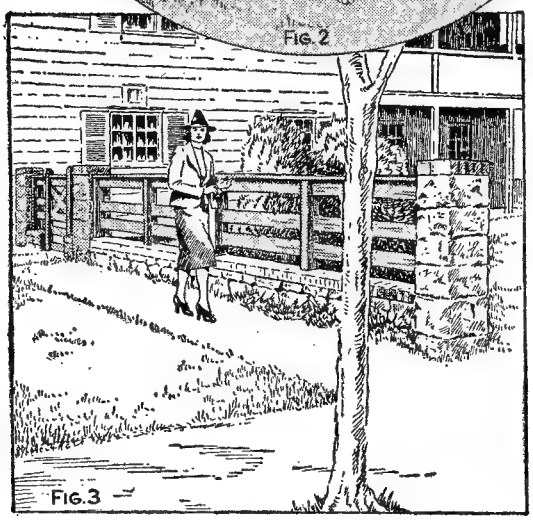


FIG. 3

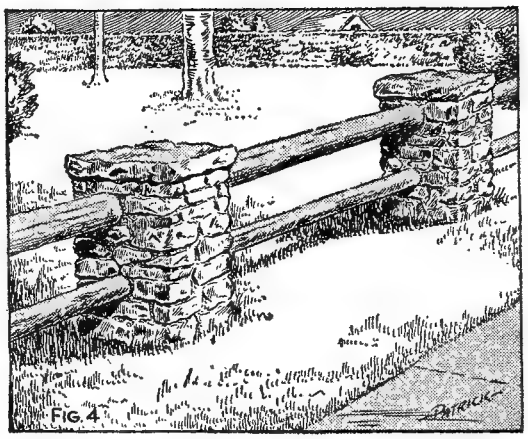
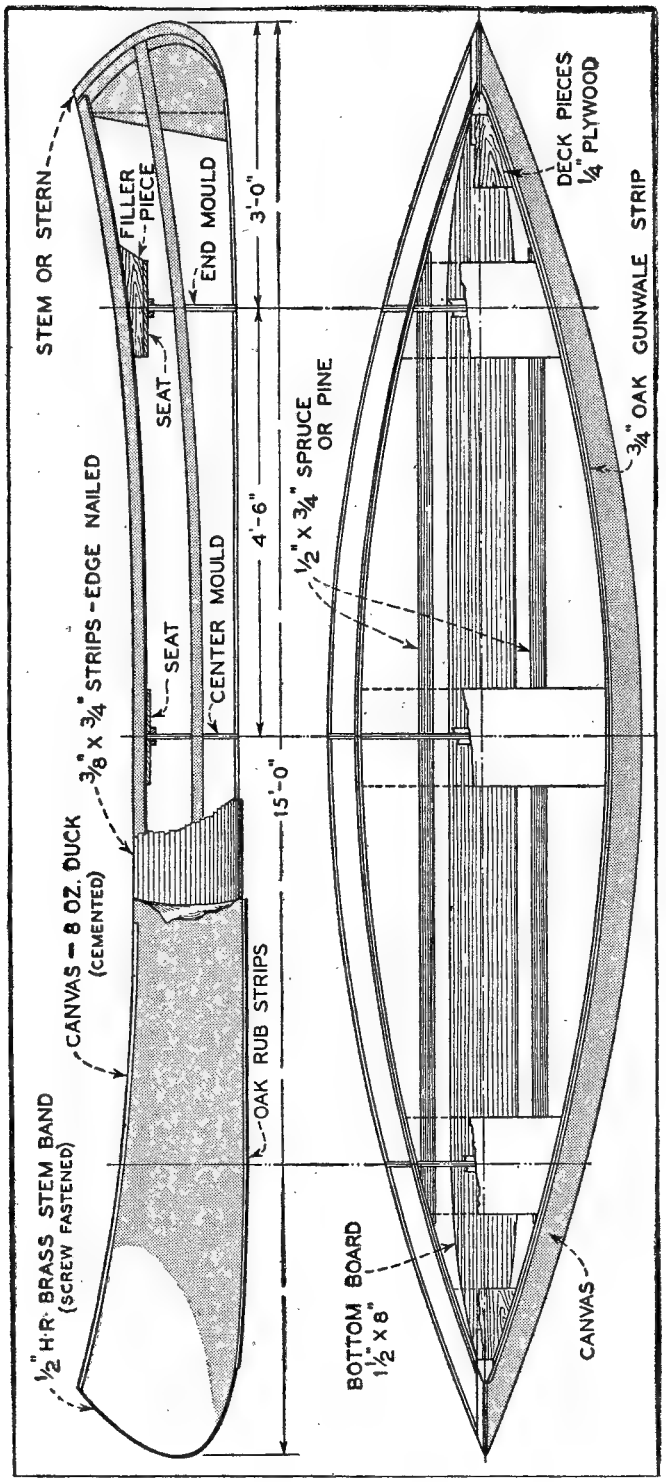


FIG. 4

GYPSY— 15 FOOT

by
J. A. Emmett



Profile and top view at left show general dimensions and construction details. For a light, strong job cedar planking is recommended.

WHILE canoes have always had a greater appeal than perhaps any other type of boat, especially to those who like to hunt and fish, the thought of having to steam and bend in the fifty some odd ribs necessary in their construction discourages most men from attempting to build one. There are no bent ribs in this fifteen-footer: edge-nailed strip construction is used with plywood bulkhead moulds; the same type construction as is being so successfully used now aboard even large boats to give all the lightness, strength and grace associated with round-bilged boats without the trouble of steam bending.

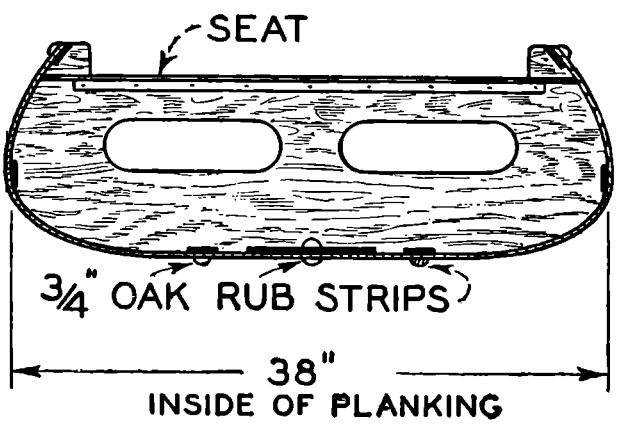
Main members are the three moulds or bulkheads with seats attached, the stem and the stern, all of waterproof plywood (Super-Harbord). These are connected by a wide cedar or pine keel, a gunwale and two other stringers each side, and the thin strip planking nailed to each mould, to the stringers, and edge-nailed to each other. The canvas covering finally cemented on bonds everything together, and the gunwales, rub strips, and stem and stern bands complete the canoe. A list of materials required is given; refer to it and the drawings as you read this.

Get out the moulds and the stem and stern first from ½-in. Super-Harbord. You can use thicker plywood than this if you prefer, but anything thinner than ½-in. is not suitable as it will not give sufficient bearing surface for the strip planking.

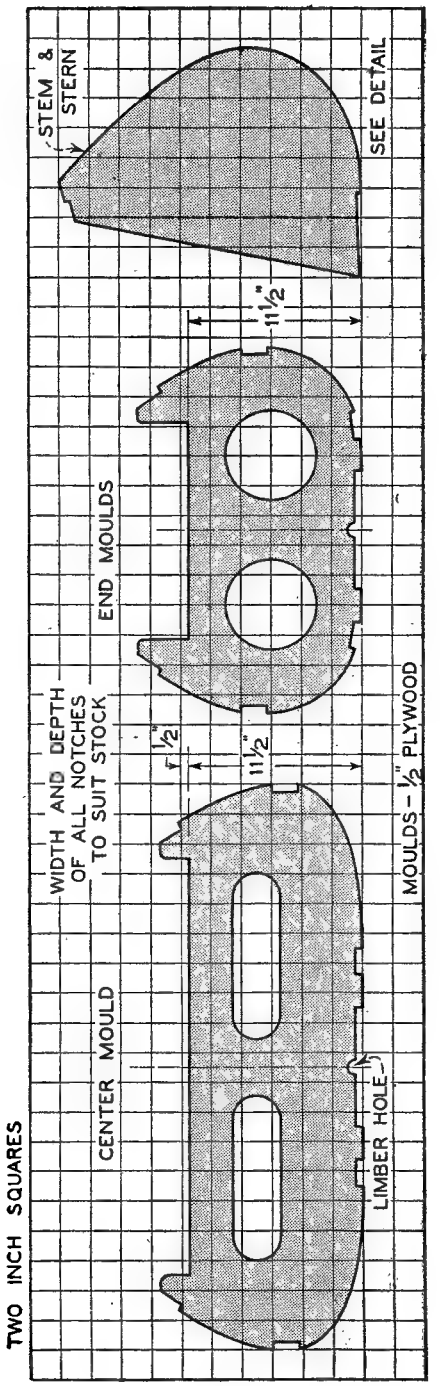
STRIP BUILT CANOE

You don't have to steam bend any ribs to build this sturdy, light-weight canoe! Construction is modern and simplified, using waterproof plywood forms. Plans and instructions are clear and very easy to follow.

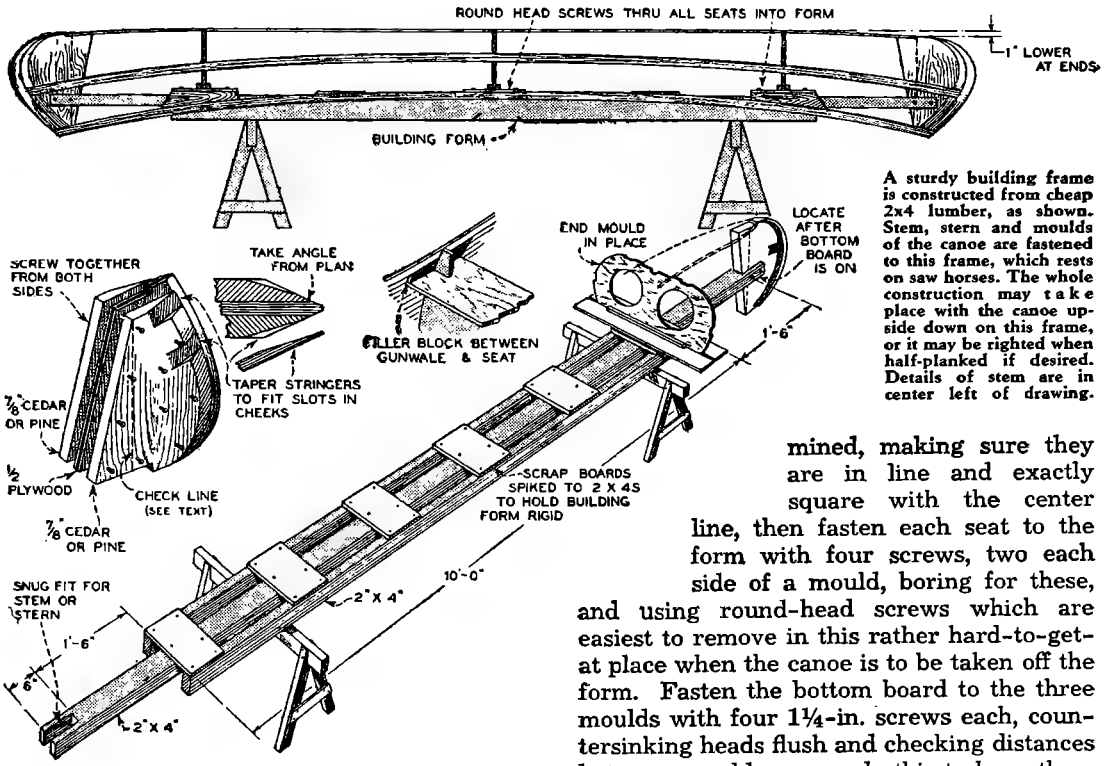
Of course, whatever the thickness, any plywood other than the marine variety will fail miserably even though in this case it is not in direct contact with the water. The mould, stem and stern plan has been ruled off into squares representing 2-in. Use building paper, laying it off in like 2-in. squares and draw in the outlines of the moulds. One must have both sides of a mould alike; the easiest way to do this is to draw one side carefully, then fold the paper exactly along the centerline of the mould and use carbon paper or prick through with an awl along its outline, when the pattern is cut out accordingly and transferred to the plywood. Another way is to transfer the pattern for one-half of a mould to the plywood, then turn the pattern over to give the other half. Check carefully the dimensions given, 11½-in., to insure the bottom of the canoe being true, and use one end mould to make its mate; also the stem to make the stern as these too, are alike. In the moulds the cut-outs shown save a little weight but need not be exactly as shown. The notches should be a crowding fit for the bottom board and the other stringers; use pieces of these to determine the depth and width of the notches, having them preferably a trifle shallow and narrow when a shaving



CROSS SECTION
AT CENTER MOULD



Moulds are of half-inch Super-Harbord (marine plywood) and constitute principal strength members of hull. The holes in the moulds may be cut to whatever size and shape desired as long as they are not large enough to weaken the plywood.



A sturdy building frame is constructed from cheap 2x4 lumber, as shown. Stem, stern and moulds of the canoe are fastened to this frame, which rests on saw horses. The whole construction may take place with the canoe upside down on this frame, or it may be righted when half-planked if desired. Details of stem are in center left of drawing.

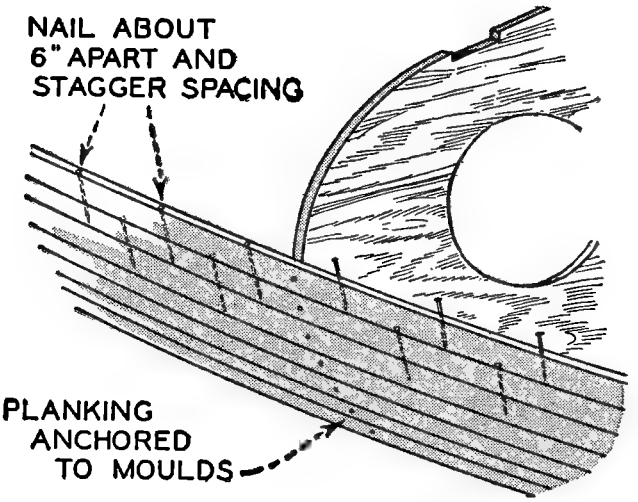
can be taken off the pieces to get them in. Do not forget the limbers or drainage notches above the bottom board notch. The plywood stem and stern pieces are reinforced by cheeks of ⅞-in. cedar or pine screw fastened both sides as shown to give the strips better bearing at the ends and permit notching in for the stringers.

Make the building form next: two pieces 2x4-in. 10 ft. long are connected with rough crosspieces 12-in. long. Spike another 2x4, 14 ft. long, beneath this as shown and cut a notch 2¼-in. wide and 6-in. deep into each end of it—the thickness of the made-up stem and stern, which crowd in here. Fasten the seat boards atop the moulds next: these are of ½-in. plywood also, notched out to let the upper shaped ends of the moulds project. Fasten with 1¼-in. No. 8 screws through the seat into the mould and reinforce with the ¾-in. square strips each side into both as shown. Leave the seats 2-in. longer each end than necessary, the excess being cut off later.

Run a line between the stem and stern notches to mark along it the exact center of the building form with other marks 4 ft. 6-in. out towards each end. Set the seat-fitted moulds in the positions thus determined, making sure they are in line and exactly square with the center line, then fasten each seat to the form with four screws, two each side of a mould, boring for these, and using round-head screws which are easiest to remove in this rather hard-to-get-at place when the canoe is to be taken off the form. Fasten the bottom board to the three moulds with four 1¼-in. screws each, countersinking heads flush and checking distances between moulds as you do this to keep them erect. This bottom board should now be flat: fasten its ends to the stem and stern which are still free in their form slots, using six screws each end, two into the plywood edge, two into each cedar cheek piece. You will notice a dotted line on the stem and stern pattern; have this on the actual members too, so you can keep it plumb or at least the same distance out each end while you pull the stem and stern down in their notches until both are an inch below the line of the moulds, then fasten with a couple of screws through the form tips into the stem and stern. This gives the ends of the finished boat a slight rake up to make for easier paddling, and as you want to have both ends look alike be careful to have both stem and stern fastened in the same position in their notches.

Fit the two bottom stringers next—they end a couple of inches beyond the end moulds —with two 1¼-in. screws into each mould. Then the stringers at the turn of the bilge and finally the gunwale stringers, the two latter sets screw fastened into the stem and stern; 1-in. screws will be long enough here as they must be countersunk slightly to permit planing off the ends of the strips to let the planking hug the stem and stern. It will be noticed that the gunwale stringers hug the top of the center seat but are slightly over

the other ones. Screw fasten from the bottom of the center seat into the gunwale strips with four 1¼-in. screws each end and fit blocks to fill spaces between other seats and the stringer. Fasten up into these from beneath also, having the outer surface of each block flush with the outside of the gunwale stringers so when planking you can fasten into these to tie seats in place. Excess ends of the seats can now be sawn off flush with the gunwales so they will rest up against the planking as it is put on. All the while you are fastening the stringers in place make sure the moulds are not getting out of true but are being kept plumb as the shape of the completed canoe is naturally dependent on the trueness of the frame. You will notice in building this upside-down way fastenings such as those through the seats into the stringers go in from above in an easy to get at way, but are out of sight when the canoe is turned over in use.

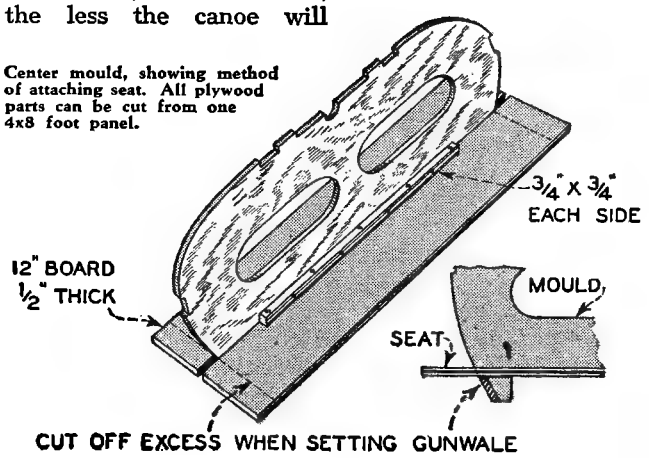


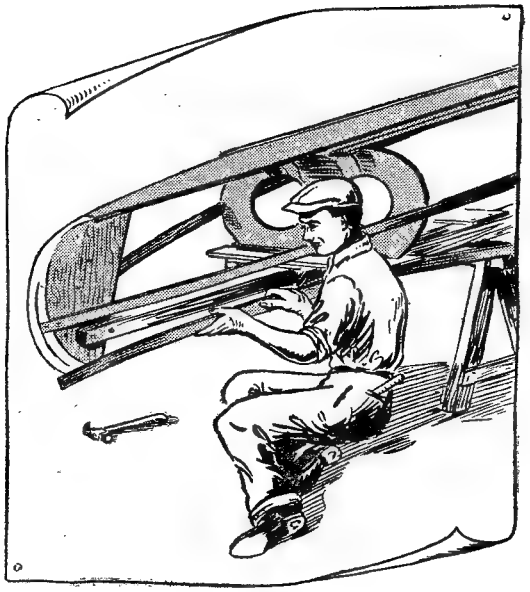
The narrow strip planking is fastened to the stem, stern and moulds, and each strip is nailed to the one next to it with galvanized finishing nails.

Before commencing planking go over the entire frame to see if the bottom boards or the stringers are projecting beyond the edges of their moulds—it is usually necessary to take off a shaving here and there along their edges to permit the planking fitting tightly and being nicely rounded. Side and gunwale stringer notches into the end moulds should have been beveled to allow for these stringers making in towards the stem and stern and the end edges of these moulds should be beveled now to match.

Full-length strips of any easily nailed wood can be used for planking: the lighter the wood used, such as cedar, the less the canoe will weigh. ¼x1¾-in. lattice can be used, strips being ripped in half at the mill to make them narrow enough to permit edge nailing. If stock must be gotten out specially have strips slightly thicker, ⅜-in., to make for easier nailing. A good way is to have the mill set their saw to cut ½-in. strips from wide ¾-in. thick boards then run one side through a planer to finish ⅜-in. thick. The other side can be left rough as the outside of the canoe must be sanded flush after planking anyway, and there is no advantage in having the edges of the strips dressed. A much better job can be done by having a can of liquid marine glue handy to paint the bottom board, the edges of the moulds and the stringers as you come to them while planking. Run the first strip down the center then work out from it to plank alternately a few strips each side. If one side is entirely planked first the framework is apt to be twisted out of true. Use very thin galvanized wire nails, either finishing nails or with a head, ¾-in. long into the bottom board and stringers, 1½-in. long into the moulds and through the edges of each plank 6-in. apart into the preceding strake. The fact that the canoe has greater girth measured around the center mould than around the end moulds with still less toward the stem and stern complicates planking just as it does with any round-bilged boat. The correct way is to taper every strip from full width in the center to ½-in. wide at each end to allow

Center mould, showing method of attaching seat. All plywood parts can be cut from one 4x8 foot panel.





Stringers are bent into notches in moulds and in stem and stern cheek pieces.

for this. Another way is to taper the first dozen strips on the bottom each side to ¼-in. at the ends, then lay the next dozen full width, but to taper remaining strips sufficiently to fill in the space left. Others will merely lay the strips as they come, using shorter tapered-end strips to fill in the space amidships as the ends are completed. The fact that the canoe does not depend on its planking for water-tightness but is made so by its final canvas covering makes this point less formidable. Any planking irregularities are concealed and the main thing is to cover the framework in a way that will provide a solid foundation for the canvas; any raised edges left can be planed flush in finishing up the outside. Fasten into the stringers as you come to them to afford additional strength having heads of all nails perfectly flush with the surface of the wood. The shorter nails will do toward any tapered ends of strips, and if any of the edge nails break through it will likely be on the outside when if it cannot be pulled for redriving it can be smoothed off with a sharp file to be concealed with the canvas. Splitting can be avoided by allowing the ends of the planks to project beyond the stem and stern until a few strips are on, then saw all off in line with the plywood there.

With the canoe planked go over the entire surface with coarse sandpaper on a block rubbing across the strips to take off any corners or irregularities which might show through the canvas. Round the stem and stern ends so they will not cut the canvas when you pull it across there.

The canvas goes on in the usual way: the size specified is wide enough to cover the canoe in a single piece making joining unnecessary. This rather wide width can be secured from any marine hardware house: you will also want to order a gallon of marine canvas cement and six feet of ⅜-in. half-oval brass for the stem and stern trim.

Strike a center-line down the piece of canvas: paint the hull with canvas cement, then lay the canvas in this and drive a row of ¼-in. copper or galvanized tacks along the center line to hold it while you stretch it toward the gunwales to fasten it there with tacks 2-in. apart. Pull the canvas down and forward as you go until you reach the curve of the stem or stern where you will have to cut out a V-shaped piece to pull one side over and tack it in plenty of cement. Do not cut out too much but trim off the excess beyond the tacks after fastening. Then smear the edge with cement and pull the other side over to tack it. Both ends are alike, of course. Your tack heads should be placed so they will later be covered by the stem and stern trim and by the half-round gunwale strips and bottom keel. Before these go on any small puckers left in the covering can be shrunk out by wetting the canvas with water. When dry screw fasten the trim mentioned above, setting all in cement, then trim off excess canvas along the gunwales and at the bow and stern.

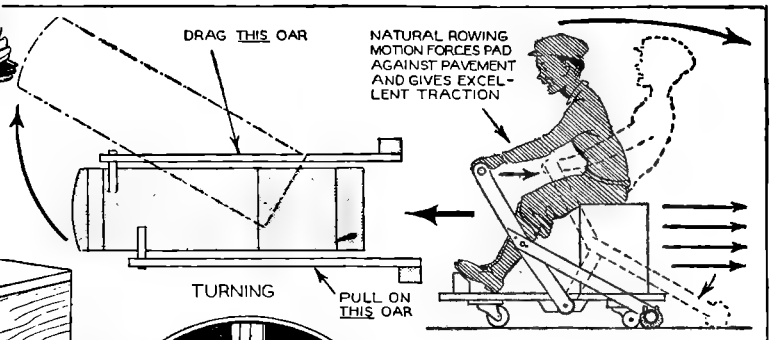
You should have enough cement left to thin half and half with common alcohol for painting on the laid canvas. This not only bonds it still more closely to the under coat but fills the weave of the fabric to make a smooth surface possible with less paint. Finish with two thin coats of deck paint, sand when well dry, and complete with a single coat of canoe enamel the desired shade. You will likely want to finish the gunwale strips with varnish for contrast and will be careful to wipe excess paint off the brass trim.

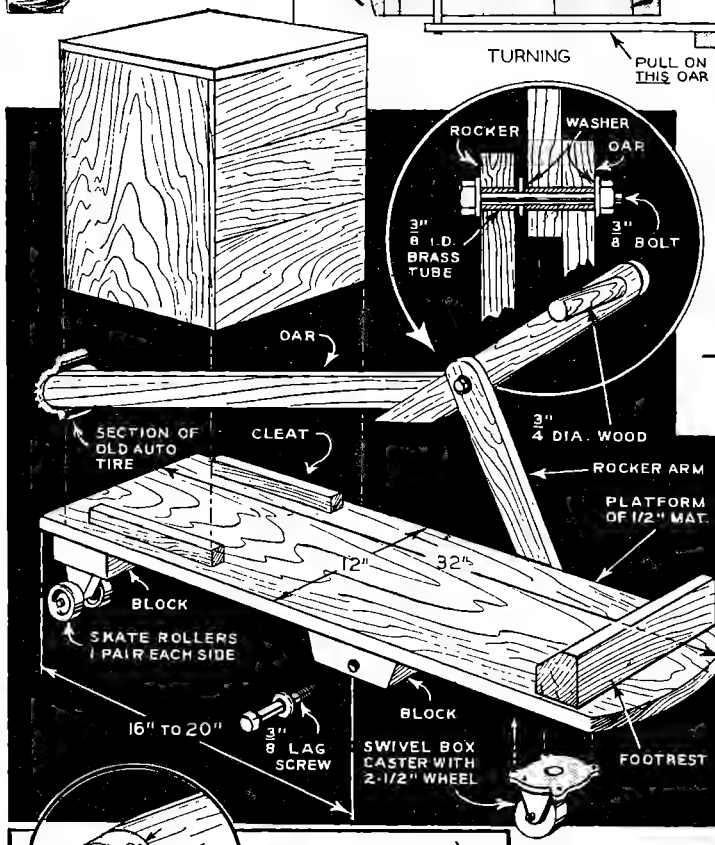
The canoe has been left on the form until now as this is the easiest place to work on its outside. To get it free reach up from beneath to saw off the projecting 2x4's holding the stem and stern and take out the screws holding the seats to the form. The remaining pieces of the 2x4 can be split out and their fastenings removed once the canoe is off the form, and the screw holes through the seats filled with plastic wood. You can add the ¼-in. plywood filler deck pieces to give the

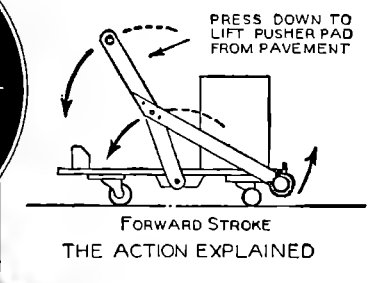
[*Continued on page* 133]

A ROW COASTER

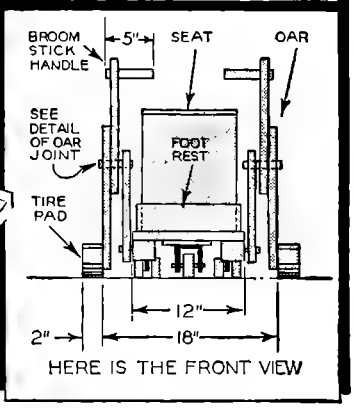
For Dry-Land Racing And Cruising



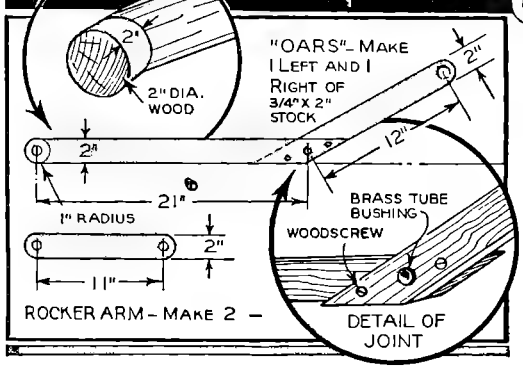




THE ACTION EXPLAINED



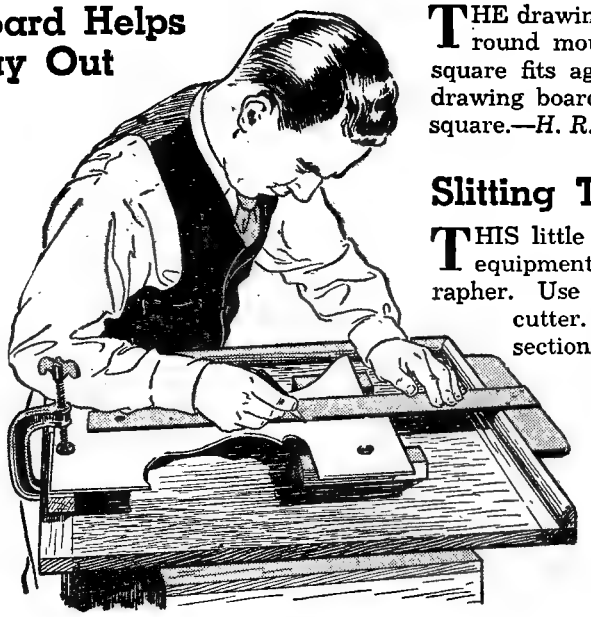
HERE IS THE FRONT VIEW



MADE from simple, inexpensive parts, a fleet of these Row Coasters will provide exercise and fun galore for all the kids in the neighborhood. So get busy and see if you can be first out with yours this spring. The frame is built of scrap wood, with a box forming the seat. Roller skate wheels are used at the rear and a swivel box caster (37c from Sears, Roebuck) under the front end. The pushers or oars consist of two pieces joined at a 30 degree angle and attached as shown

[*Continued on page* 144]

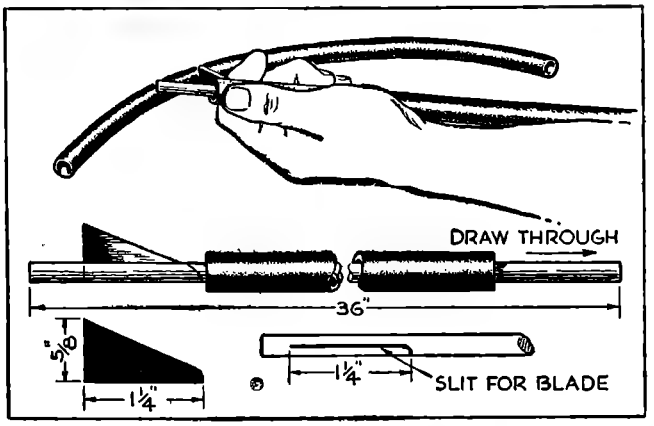
Board Helps Lay Out



THE drawing board should be fitted with quarter round moulding on two sides as shown. The square fits against these. Material is clamped to drawing board and the work laid out with the T-square.—*H. R. H.*

Slitting Tool For Rubber Tubing

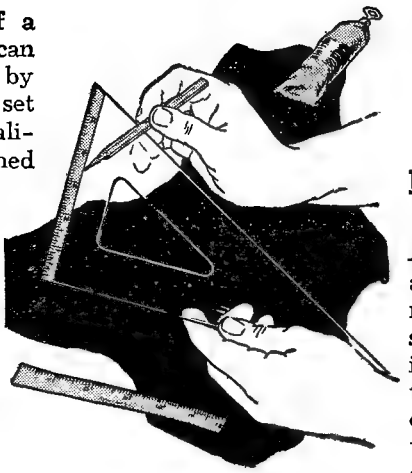
THIS little tool will be a useful addition to the equipment of the amateur chemist or photographer. Use doweling as handle and shank of the cutter. For the blade you can use a triangular section broken from a safety razor blade.

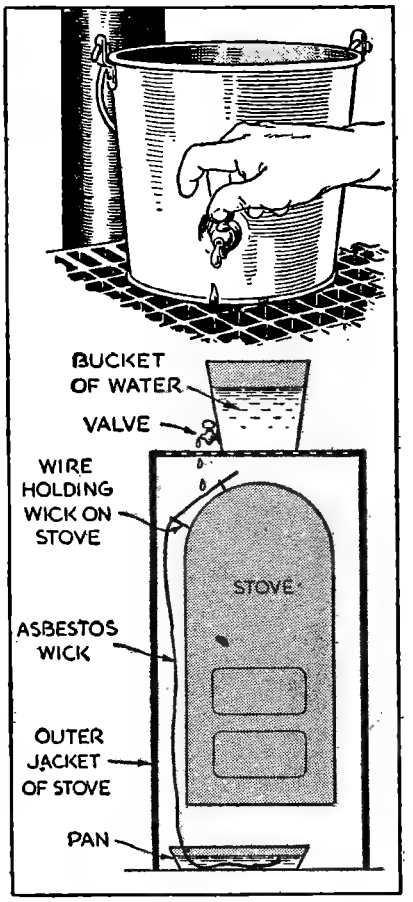


Calibrations Improve Triangle

THE efficiency of a celluloid triangle can be greatly improved by marking it off with a set of calibrations. The calibrations can be scratched on the edge of the triangle with a sharp pointed instrument and made more visible with India ink.

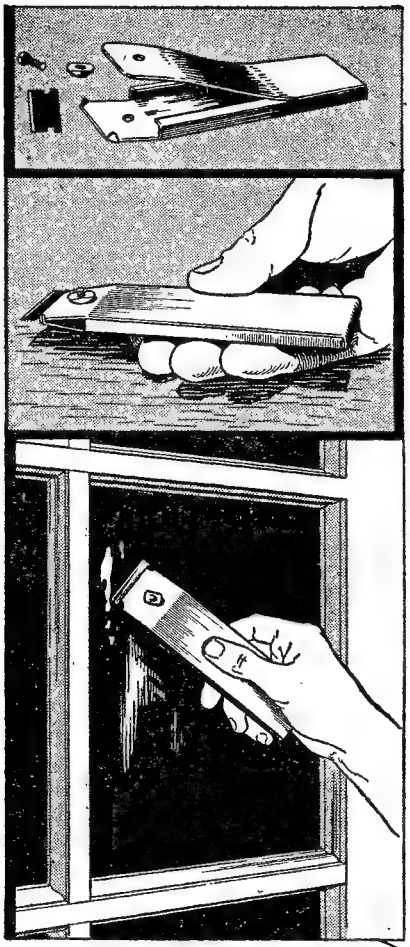
Another method is to cement calibrations from a thin celluloid ruler to triangle.





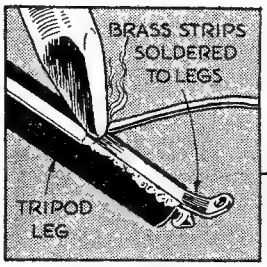
Efficient Humidifier

A BUCKET, spigot, asbestos wick and shallow pan can be arranged to provide excellent humidifying for rooms heated by the square type coal stoves with grate in top. The spigot is fastened in the pail and set to drip water one drop at a time on the wick below the grate. Cross-section sketch clearly shows setup.—*J. G. R.*



Suction Cups Hold Tripod

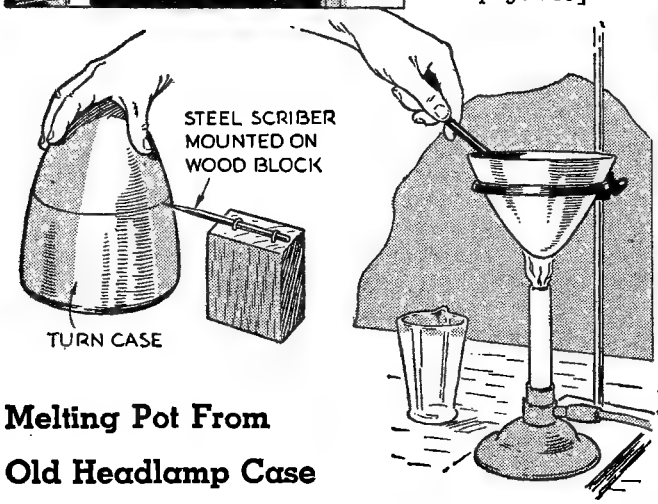
IT IS very important when the midget tripod is used in closeup work that wobble be eliminated. The use of small rubber suction cups will cause the tripod to be held solidly. The cups are attached as illustrated. — *H. R. H.*



Holder For Razor Blade

AT LEFT is a handy holder for single edge razor blades. A 12½-

[*Continued on page* 135]



Melting Pot From Old Headlamp Case

A DISCARDED bullet type auto headlamp case can be utilized to make a neat and useful melting pot or crucible for the shop. Use a hacksaw to cut the end out of the case. A ringstand will hold the pot for use.—*W. C. W.*

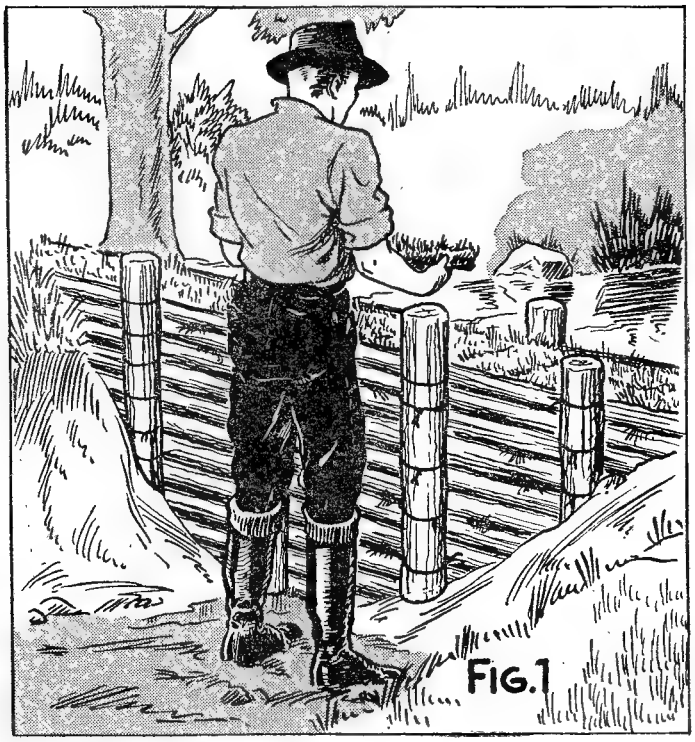
Protecting Skin From Paint

WASH your hands and arms with your regular toilet soap, working up an extra thick lather. That's all. Don't rinse; don't dry. Wave your arms a second or two and they're dry. Paint will get on just the same, but it will not stick.—*M.W.H.*

DAM THAT STREAM!

by

Dale Van Horn



The sturdy construction of this dam is plainly visible.

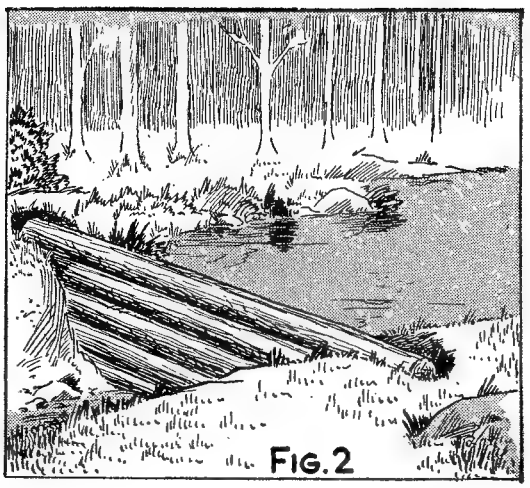
BUILDING dams is always fun, even when next morning's dawn shows them washed out again. Dams, however, can take on a very practical use when applied to the summer camp. Not always, but often.

There was the camp party that struck through the woods one summer and after arriving at the camp site, found the drinking water source a little trickling spring from which you couldn't lift a dipper of water without muddying it. The remedy was simple, however, as shown by Fig. 4. Strips of sod were cut with the spade and laid, sod house fashion, to form a curved bulwark against which the spring water slowly rose. Within a few hours the water was clear and the pool deep. An inch layer of gravel sprinkled over the bottom improved conditions and sparkling cold drinking water in ample quantity was assured for the duration of the stay.

One of the most effective dams to make is shown in Fig. 2. If the banks are quite close together and the flow of the creek not large, you can make this dam in a little while and it will remain at least until the next heavy flood. You merely cut trenches in each side of the creek bank, facing each other, down to a little below water level and wide enough to take the ends of small logs. These you fell, trim, cut to length and roll into place, one on top of the other. Chinking is done with moss and clay. The earth is then thrown back around the ends of the logs. You can rig up a pretty fair swimming hole in an afternoon in this manner.

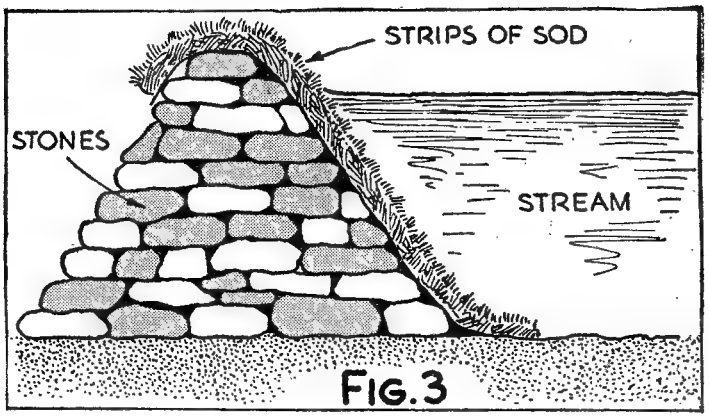
Merely piling rocks and covering them with strips of sod as in Fig. 3 will make a good dam. Be sure to make the stone base broad. If the water flow is slight and sod lacking you can chink the stones as you lay them with sand and clay. The water overflow should be over a smooth stone a little lower than the rest of the dam.

Another engineering feat with a little planning and not much work is the dam shown in Fig. 1. This comprises two rows

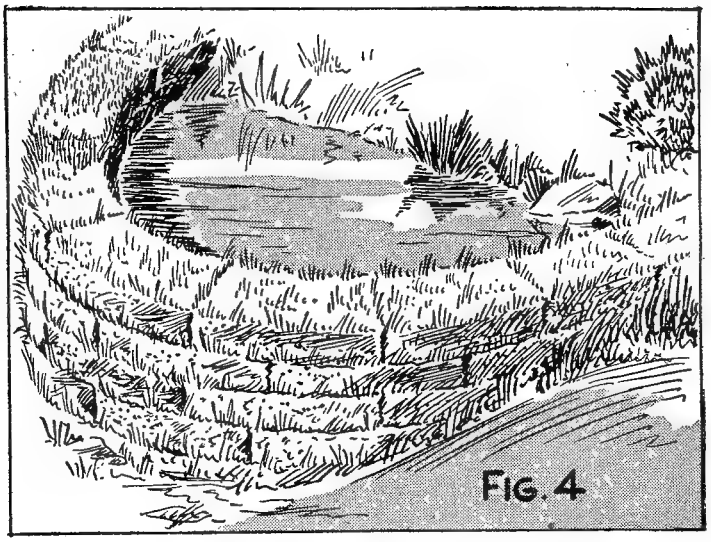


All you need is an axe and shovel for this one.

Here are five good ways to establish a water supply in the open country. For campsites or lawns, dams of this type combine utility with beauty. Any of them can be constructed easily by one man with no other tools than those to be found in every camping outfit. The amateur landscape enthusiast can readily adapt them to use as lawn pools.



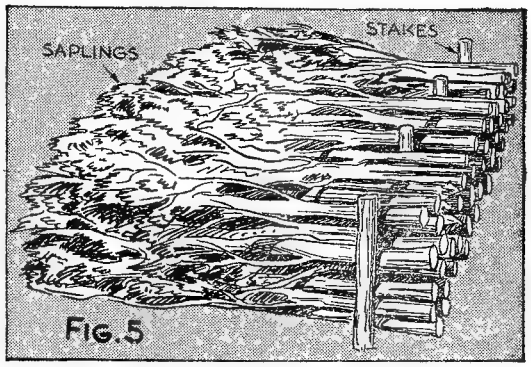
Where wood isn't plentiful, try this one. Just pile the stones and the sod.



Let the water be dammed—artistically. The stacked still-life beautifies it.

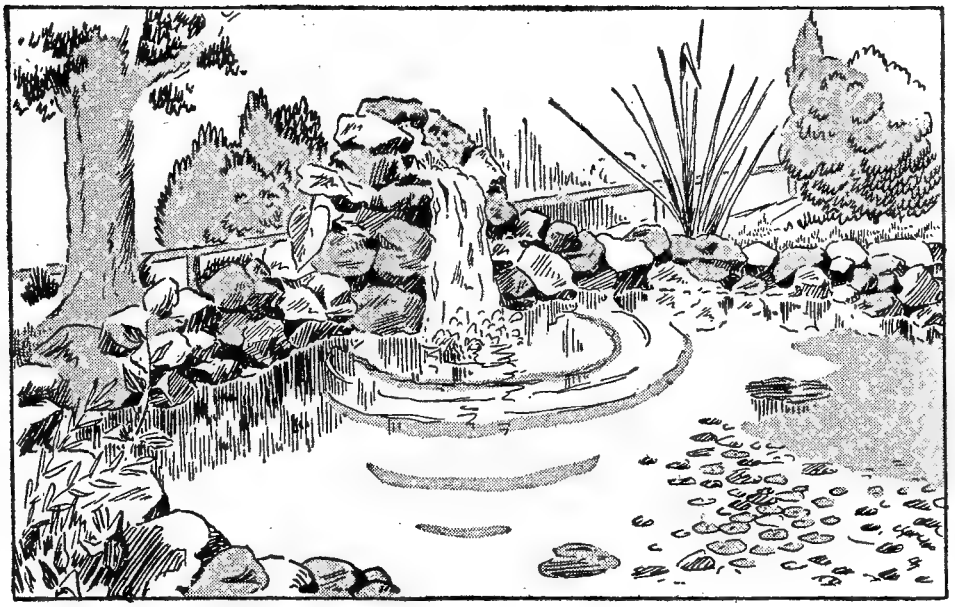
of stakes driven into the stream bed 14 or 15 inches apart. Saplings are then cut, trimmed and lashed to the stakes to form two walls as indicated. Wire or cord should be used to hold the saplings in place. When this has been done, the space between the sapling walls is filled and packed with earth to form a dam which, in at least one case, lasted all summer.

The sapling dam, Fig. 5, smacks of beaver tactics. Its purpose is a bit different. Stakes are again driven into the stream bed and saplings and shrubs cut and laid as shown, one tightly upon the other. The water flows through but in time sediment and trash collect in the brush to raise the water level—and, best of all, form a nice fishing spot. The dam is especially appropriate for the stream devoid of many good fishing holes. Action of the water scours the bed deeper just above the dam, too, so the stakes should be driven deeply.



This makes a fisherman's paradise quickly.

Dams of the types shown can easily be modified for lawn use. Where one is fortunate enough to have a stream "in his own backyard" he is usually able to give some attention to landscaping. Most of these dams could be built to last almost indefinitely by merely putting a little extra diligence into the construction. Attention from time to time when necessary, would then maintain them in good condition. An artificial pool created in this manner would provide a haven for romantic individuals and juvenile naval architects.



Garden Pool and Waterfall

NO MATTER how hot the day the mere sound of a waterfall seems to lower the temperature. Good for the eyes, too. It is no trick at all to build one—a matter of laying pipes, mixing concrete and piling up stones. The diagram shows the simplicity of the job —elbow grease is the main requirement.

The pool is nothing more than a shallow excavation with 6 inches of concrete spread over. There should be a reinforcing mesh laid in it. Piping should be installed before pouring the concrete. For strong, water-tight concrete, the amount of water used per sack of cement is of greatest importance. With dry sand and pebbles the recommended mix is 5½ gallons per sack, or 4¼ gallons if the material is moist. A one-two-three ratio of Portland cement, sand and pebbles will be satisfactory.

Now about the pumping plant; first pick out a centrifugal pump with an impeller no larger than 5-in. diameter—smaller will be satisfactory for a ¼ h.p. motor if the water

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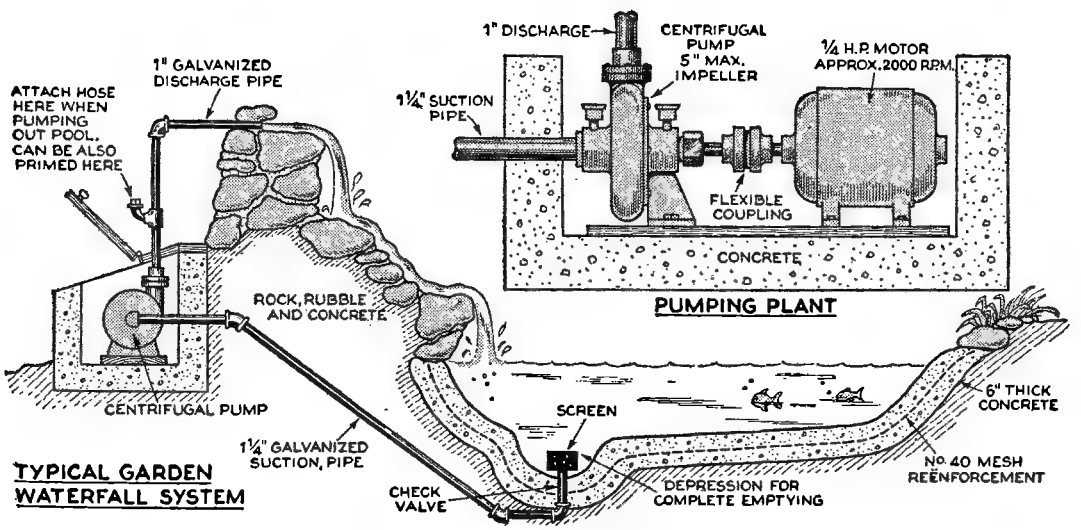

MAKE A NIGHT LIGHT
FROM GLASS TOWEL RODS

THIS novelty night light for the radio or any dark corner takes advantage of the fact that light tends to follow the length of a solid glass rod. The result is a thin, vertical streamer of light, slightly yellow in tone, with a bright ball of light at the top. Basically, this is the principle. The adaptations are many.

For our purpose, let us design a suitable setup, not too difficult to make, which will look attractive in use and carry

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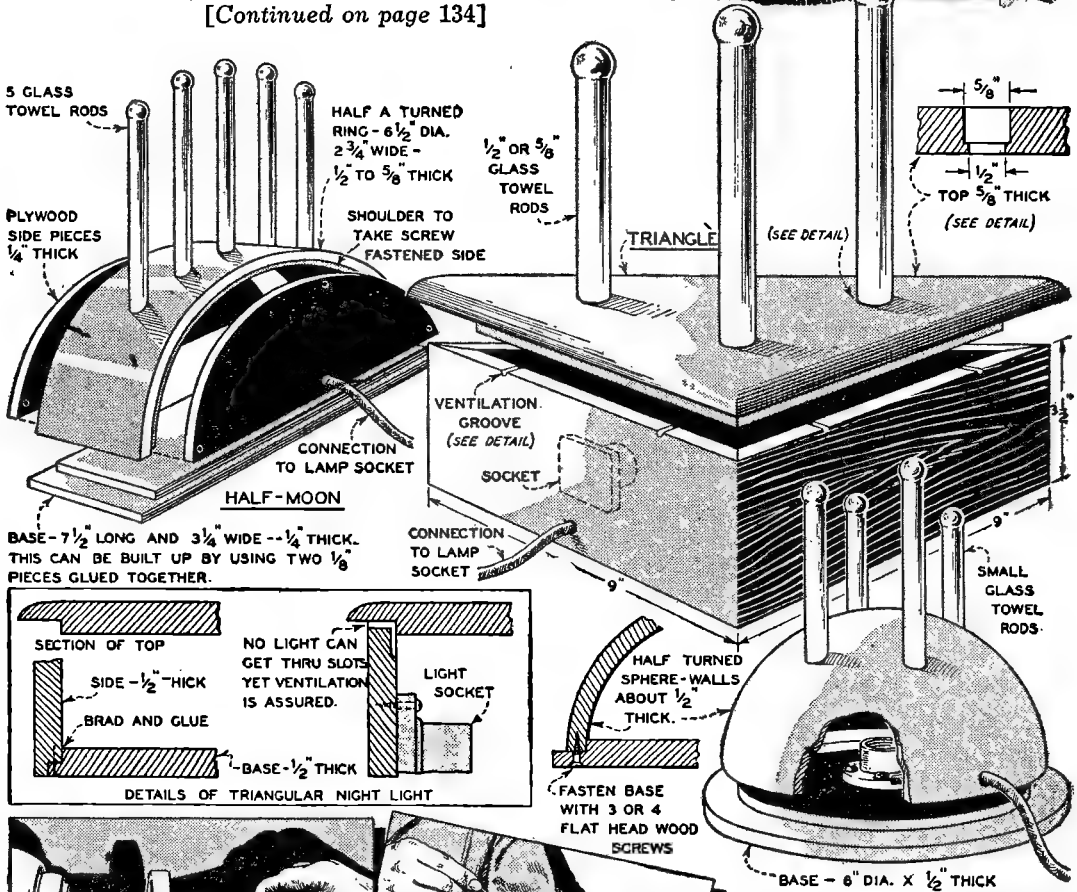


Steps in cutting the glass rods are shown above. The rod is first grooved shallowly on the emery wheel (left), then heated with a blow torch or bunsen burner (center), after which cold water is dropped in the hot groove as the rod is rotated. This treatment will cause a clean break.

HITCH YOUR BOAT TO

THE Star automobile motor has long been the pet of the amateur conversion artist. The simplicity of the transmission and driveshaft design is the chief reason for its popularity. Assembled as distinctly separate units, the entire driving mechanism of the Star car lends itself admirably to the marine conversion.

The condition of the motor is not of paramount importance because replacement parts are still available at junkyards and many auto supply houses. A jaunt through one or two yards should reveal a motor in sufficiently good condition for use.

The four-cylinder motor is fairly light and easy to handle with the ordinary type block and tackle. If convenient, it is advisable to lift the motor into the boat and place it in the approximate position it will occupy, before beginning the actual conversion work. This will permit more accurate measurements and estimates of propeller shaft length and position. It will also prevent awkward pipe connections, etc., around the boat's frames and structural members.

The Chinese junk finds some nautical competition from the American junkyard when the Stars foretell the future. Yesterday's automobile engines go down to the sea in ships and let the mariner shift for himself —with a three-speed transmission. Here is a simple marine conversion of the old four-cylinder Star automobile motor.

COOLING

As the oil in the engine is likely to overheat in marine use, a piece of flattened 1" copper pipe is run through the bottom of the crankcase, or pan. The ends of this should be brazed or soldered around short lengths of ½" pipe. The latter are then welded around their points of entry to the crankcase. The general position of this cooling pipe is shown in the drawing. The forward end of the pipe is connected by means of a length of garden hose, to the intake scoop on the boat's bottom. This scoop is a ½" to 1" increaser elbow facing forward. It will be necessary to run a short nipple through the bottom of the boat as the elbows are too short. Use washers inside and out for watertight fit. It is a good idea to solder some coarse screening over the scoop-mouth to prevent clogging.

The rear end of the cooling pipe is connected by a similar garden hose arrangement to the intake of a ½" centrifugal water pump. This pump is driven by a Vee belt as shown. It is important that the pulley ratio indicated be adhered to since the pump must run at considerable speed in order to function properly. The pump should be placed below the waterline to eliminate priming.

After being sucked in through the crankcase cooler, the water is driven by the pump, up through the engine water jackets and the manifold cooler. In order to attach the pump connection to the jackets, the impeller must be removed where the water enters the engine, and a short piece of ½" pipe welded in its place. A similar piece is welded to the cylinder head for further connection where the water leaves.

The manifold cooler is a length of thin ½" brass pipe, shaped to lie flat on the manifold, and held in place with steel tape. The water enters this cooler through a length of garden hose from the ½" exit pipe on the head. It is wise to carry the brass cooler pipe an inch or so from the manifold so that the connection point will not be too hot for the rubber hose.

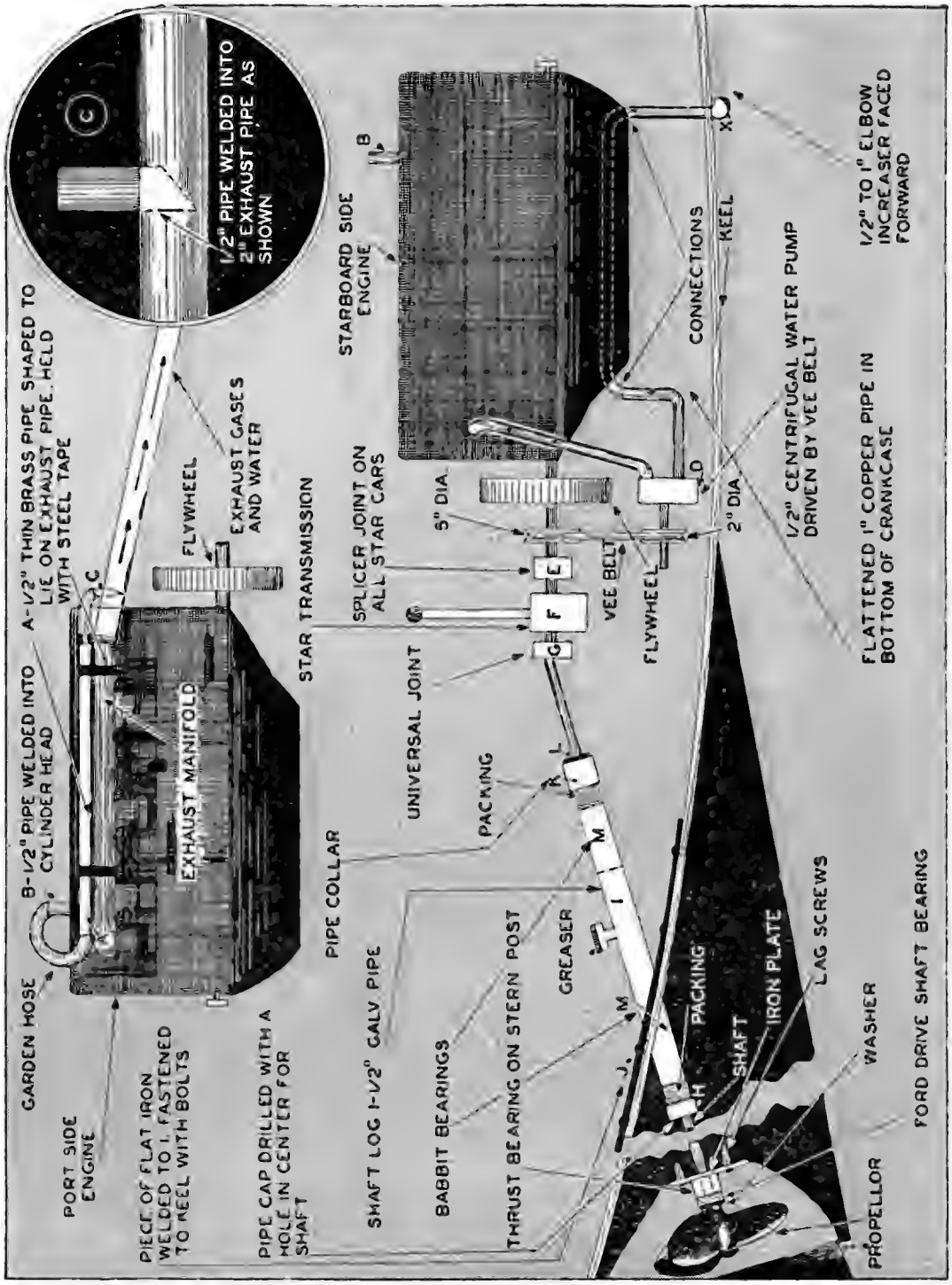
The outlet end of the cooler is connected similarly to a piece of ½" pipe welded into the exhaust pipe as shown. The angular end of this water pipe is designed to prevent backfires from driving water into the engine's valves. The cooling water finishes its journey by running down the exhaust pipe and out. Naturally it cools the pipe on its way. The exhaust pipe should be given a fairly steep slant downwards away from the engine. Use 2" pipe.

TRANSMISSION AND DRIVESHAFT

The original transmission and shaft arrangement is retained intact back to the

[*Continued on page* 142]

A STAR-CONVERSION



REPAIRING MOTORCYCLE

THE fitting and repair of control cables on motorcycles, and also on bicycles using hand-controlled brakes, is something which the average person seldom understands; however, by adhering to the following simple instructions almost any job can be cheaply and easily done.

Handy Iron

A very handy iron for soldering the strands of a control cable together can be made by simply cutting a notch across one of the tinned faces of the bit. This forms a small reservoir in which the solder collects. When the inner cable is laid along the notch, the solder flows freely through the strands, holding them securely in place. See Fig. 1.

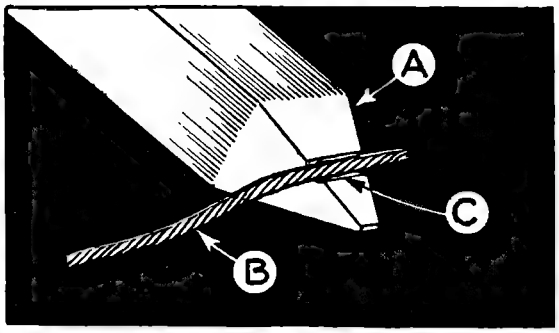


Fig. 1. The control cable (B) is shown in groove (C) of tinned face of soldering iron head (A). An ordinary file will serve to make the groove. The groove should not be sharply "V'd" as the cable would not contact the surfaces.

Fitting Nipples To Control Cables

The fitting of nipples to control cables is an easy job if the one doing the work knows his business. Fig. 2, shows how it should be done.

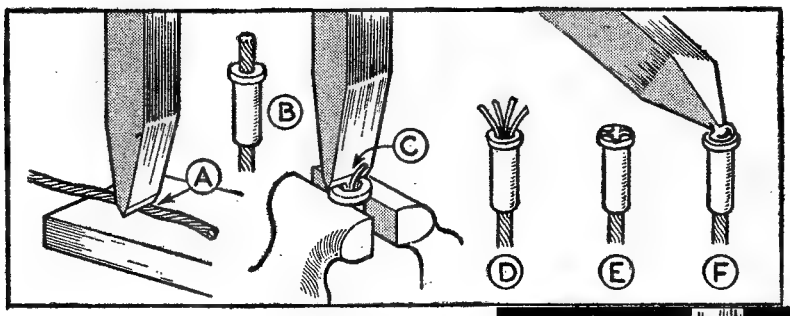


Fig. 2. (A) Cutting control cable with chisel after tinning strands to prevent fraying. (B) Nipple with control cable in place. (C) Splaying protruding cable end with chisel at outer end of nipple. (D) Cable splayed into four sections. (E) The four sections flattened for soldering. (F) Finishing with soldering iron.

If a control cable nipple drops off and becomes lost, a very satisfactory emergency repair can be made by filing down a motorcycle spoke nipple and soldering it in place of the missing part.

Cable Protection

When control cables are placed so that they become chafed by the action of the front forks, bind the outer housing with copper wire covered with a layer of electrical tape. This will prevent wear. The wire and tape can be renewed for practically no cost when necessary.

Fitting Cable-Housing-Caps

The fitting of cable-housing-caps is usually quite a ticklish job if done in the usual manner. The reason for this is that it is difficult to get the end of the housing into the cap. However, if the open end of the cap is first flared as shown in the accompanying sketches, the work can be done both speedily and easily. The illustration below (Fig. 3) shows the repair job.

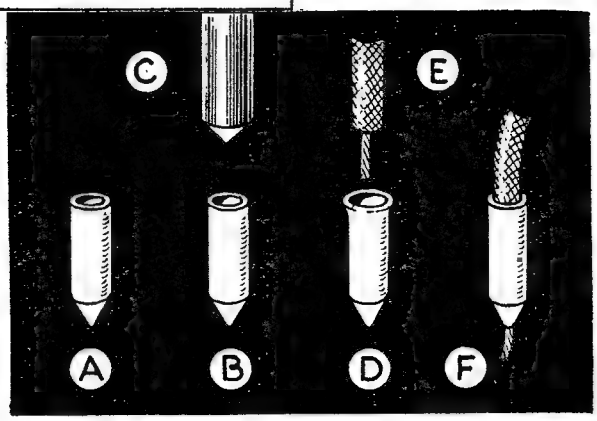


Fig. 3. (A) Cable housing cap. (B) Broken shank from an old drill bit (C), in position to flare open end of housing cap. (D) Flared housing cap ready for insertion of cable (E). (F) The finished job with the flared end of the housing cap pinched back to its original shape, gripping cable housing.

CONTROL CABLES

by Ivan J. Stretten

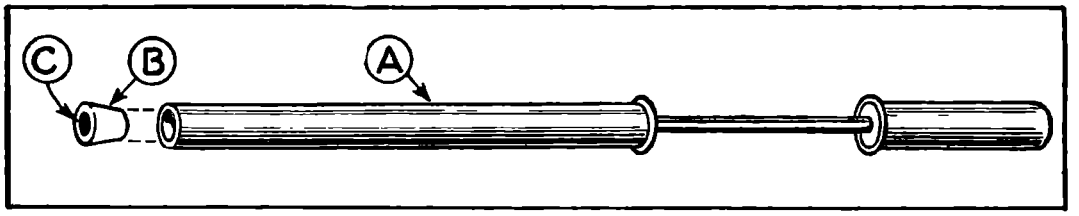


Fig. 4. (A) Pump barrel. (B) Cork. (C) Hole drilled in end of cork to admit cable housing.

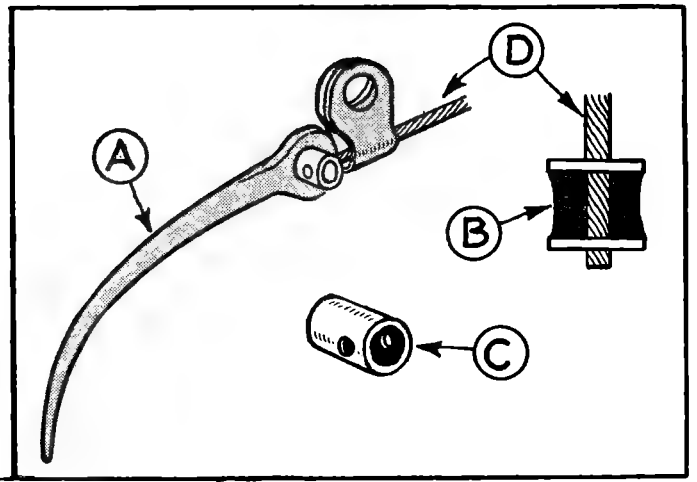
Lubricating Control Cables

Control cables may easily be lubricated by using a bottle with a split and grooved cork, to take the end of the cable housing. An equally as efficient oiler can be made by cutting the end off of an ordinary bicycle pump. A cork of suitable size to fit very tight in the pump is drilled to take the end of the cable-housing. To operate, the pump is filled with oil and the end of the cable-housing is placed in the hole in the cork, which is then pushed into the open end of the pump. See Fig. 4. Then the oil is simply pumped in.

Homemade Control Nipple

Replacing a brake-wire control nipple when the proper article is not always an easy task, but there is a solution to the difficulty. A piece of small-diameter copper tubing is cut to the required length and then drilled diametrically. One of the holes is countersunk from the outside and the cable passed through. The center bore is filled with solder, and the stranded ends of the cable turned over and soldered into the countersunk hole in the normal manner. See Fig. 5.

Fig. 5. (A) Control lever. (B) Piece of copper tubing made into a nipple by drilling a hole through it and filling with solder. (C) Copper tube after hole is drilled and countersunk. (D) Control cable fitted into nipple.



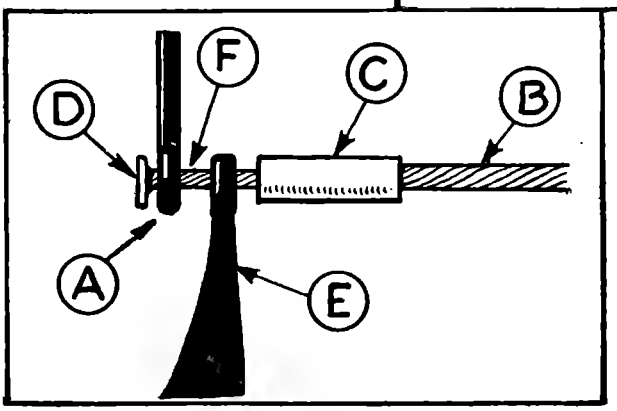


Fig. 6. (A) Cotter pin. (B) Control cable housing. (C) Control cable housing cap. (D) Control cable nipple. (E) Operating lever. The cotter pin can easily be pressed on to the cable just ahead of the nipple. When in position it will snap shut, the hole remaining at the cable.

Stiff Control Cables

Stiff control lever action may be due to a damaged cable, a too sharply bent cable, or grit in the outer housing. Repairs are simple once the trouble is found.

Eliminating Slack

When it is necessary in an emergency to take up slack in a control cable, and all available adjustment has been uti-

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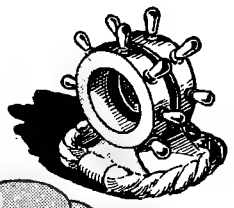
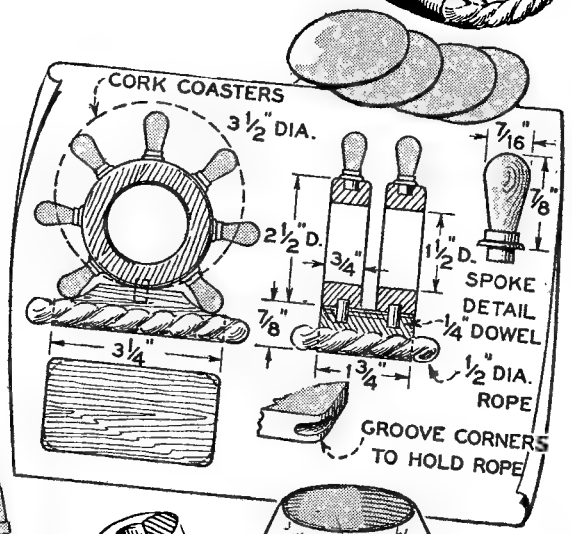
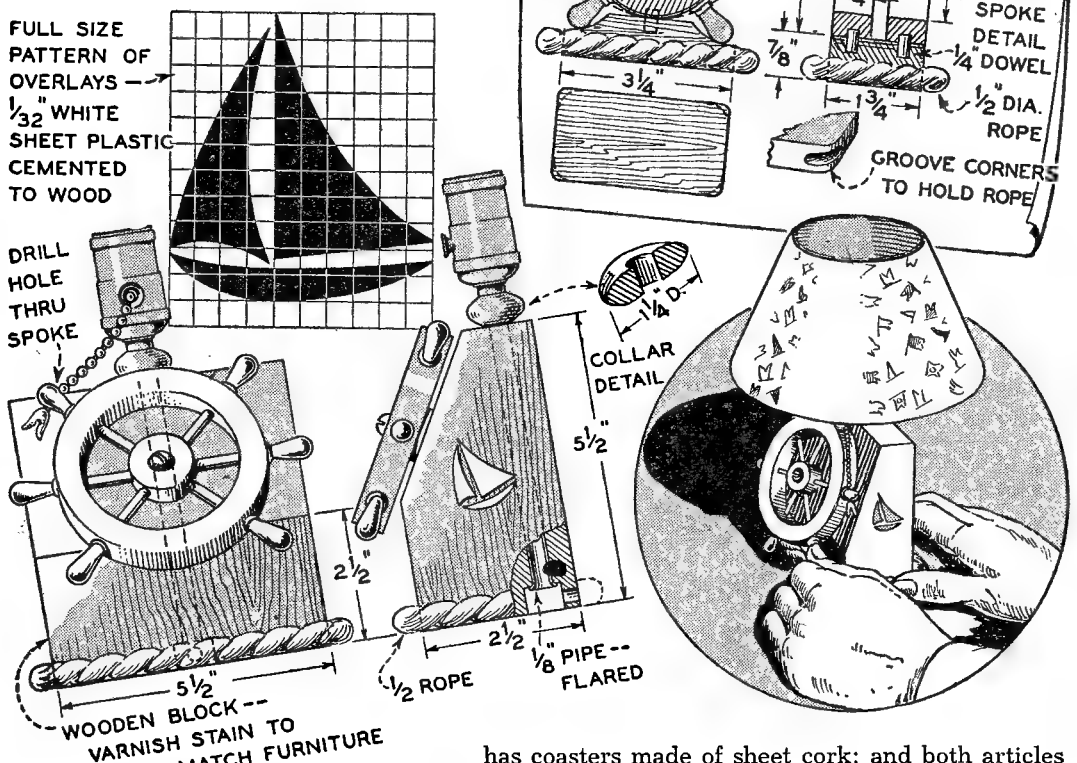
MARINE LAMP
And Coaster Combination

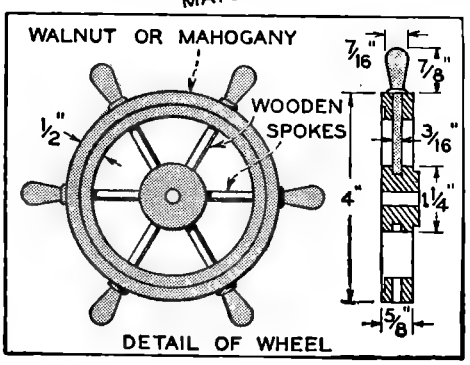
by Bruce MacIntosh



READERS who are boating fans will appreciate the matched pieces here described, for they are shipshape little gadgets. Features that are truly different are found in these two masculine projects. The lamp has a ship's wheel by which the socket switch is operated; the coaster set has coasters made of sheet cork; and both articles have a genuine salty tang in the tarry aroma of the rope base decoration.







MARINER'S LAMP—The drawings will be found practically self-explanatory, but an outline of making follows. The body block, is best made of solid stock, if obtainable, but may, of course, be glued up, using maple, birch, or whitewood, which woods are used throughout both articles. Saw and plane to shape, then drill for electrical conduit, also making the counterbore and cord holes.

Lathe turned members are next, the collar and the hub, made from one turning. Six spoke members are turned, two being made at a set up. A

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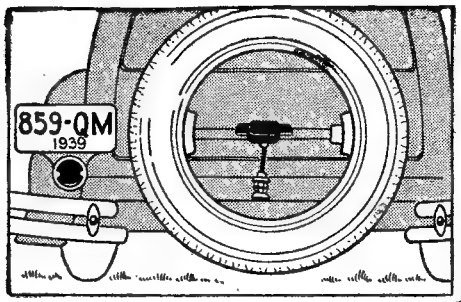
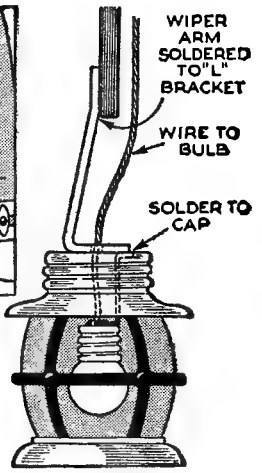
KINKS FOR MOTORISTS

Swinging Red Lantern Is Good Stoplight





MORE likely to be seen than an ordinary flashing stoplight is this red lantern that lights up and also swings back and forth. It can be made from a standard electric windshield wiper, a 6 volt radio panel bulb and socket, a glass candy-filled lantern from the five-and-ten, and a few odd scraps.

First make sure that the bulb and socket will pass through the neck of the lantern; then dip the bulb in red lacquer, touching up the lantern if necessary. Solder a 10-in. length of insulated wire

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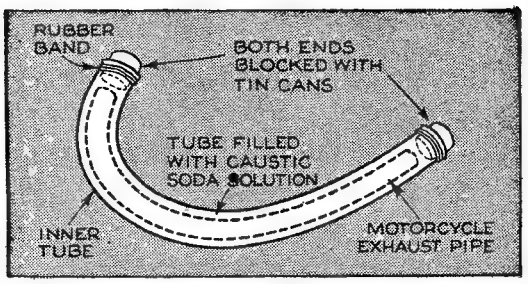
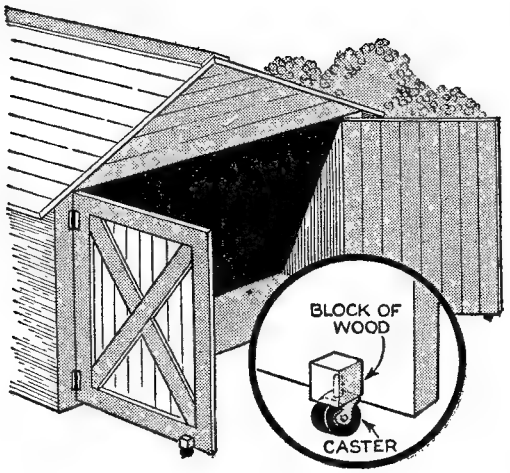


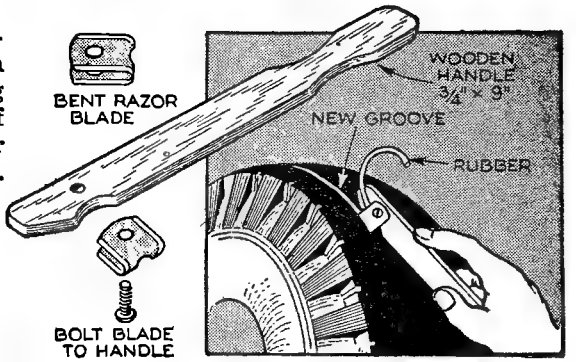
Removing Exhaust Carbon

BURNT oil and carbon can easily be removed from the exhaust pipes of a motorcycle as shown at left. A section of inner tube is blocked at one end by a tin can held in place with a rubber band. The exhaust pipe is inserted, the tube filled with caustic soda solution and then sealed with another tin. Let the pipe soak for about 45 minutes, by which time all traces of carbon will have disappeared. Wash pipe in clean water.

Casters On Garage Doors

OWNERS of garages having wide swinging doors and cement driveways can lengthen the life of the doors by preventing sagging as shown below. Bolt a block of hardwood to the bottom edge of each door and insert a heavy furniture caster in each.





Homemade Tread Regroover

THE regrooving of worn automobile treads is rapidly becoming more popular, and a cheap and reliable homemade tool for the purpose can be constructed as follows:

Obtain a piece of hardwood about $\frac{3}{16}$x¾x8-in. Shape as shown and drill a $\frac{3}{16}$-in. hole near one end. Next heat an old safety razor

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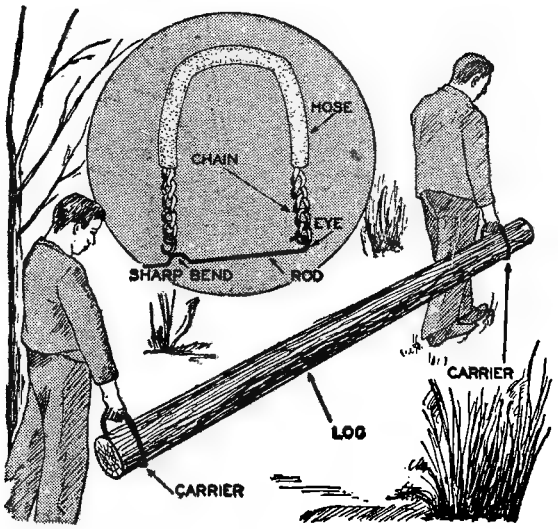
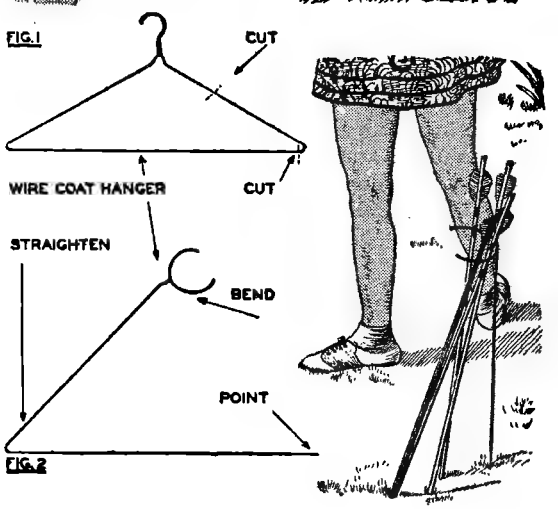
Sports and Outdoor



Easy Light Log Carrier

FOR easy lugging of light logs and poles, use this carrier made from chain, old garden hose and iron rods. The chains run through the hose for strength. The rod is provided with an eye at one end which is bent around the lowest chain link on one side, while the other end of the rod is provided with a sharp bend so that when it is inserted through the bottom link in the other end of the chain and under the log as it lies on the ground, it will be securely engaged. With one of these carriers fixed at each end of the log two men can carry it comfortably without injury to the hands.—*D. V. H.*

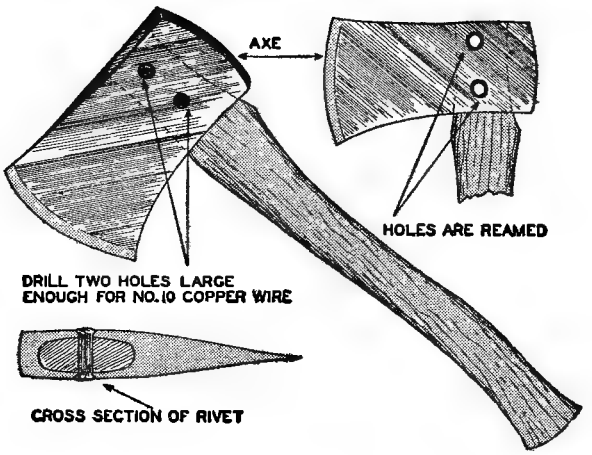


Quiver From Coat Hanger

ALWAYS useful to the archer, a ground quiver to hold arrows may be easily constructed in a few minutes from an ordinary wire coat hanger. Choose a hanger of stout wire, if possible, and cut it in the two places indicated in the diagram. Be sure that the long end and hook are in one piece, and this can be done by following the twist around. The split hanger should now be bent as shown, so that the loop will finally make a 90-degree angle with the upright. The quiver may be stuck in the ground just behind the archer and a little to one side, within convenient reach.—*Carroll E. Bradberry.*

Locking Axe To Handle

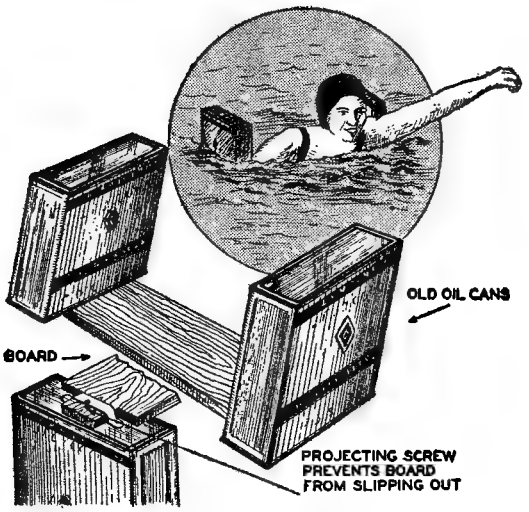
A FAVORITE axe was preferred because of long use, even though it was difficult to keep the handle tight. This was overcome in a quick, easy manner. Two holes were drilled through the axe head and handle after the two were made tight, large enough for No. 10 copper wire. Each side was reamed out slightly, then the wire, cut a little longer than the head thickness, was riveted by hammering, the reamed portion forming a head on the rivet.—*D. V. H.*



Hints for Summer

Tin Can Water Wings

TWO 1-gallon oil cans that are intact and without holes can be made into a very practical floating seat with the aid of a ¾-in. thick board fastened between them. Cut shoulders on the ends of the board so that they will fit underneath the handles on the cans. Screws, placed as shown in the illustration, will prevent the cans from slipping away from the ends of the seat. These improvised water wings will be found very buoyant and capable of sustaining considerable weight.—*K. M.*



Convenient, Collapsible Cupboard For Camping

THE collapsible cupboard brings a convenience to your camp that makes it a good substitute for your shining kitchen at home. It hangs on a tree trunk and its shelves hold boxes of crackers, potato chips, cheese, cookies and cakes. Canned fruits and vegetables, glass jars protecting bacon, candies, matches and the numerous other things needed in camp, all are easily accessible when arranged neatly in the collapsible cupboard. A little colorful shelf-paper adds attractiveness.

Here's how the collapsible cupboard is

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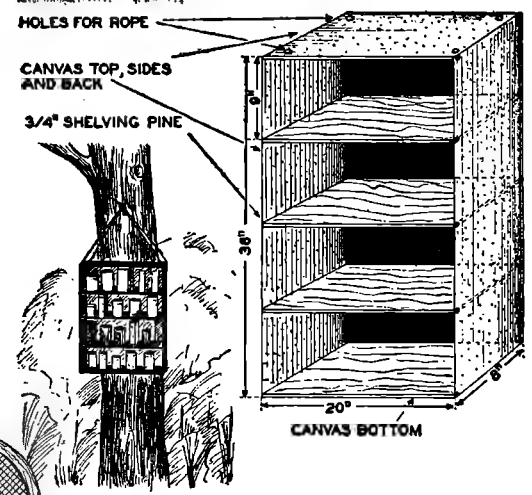
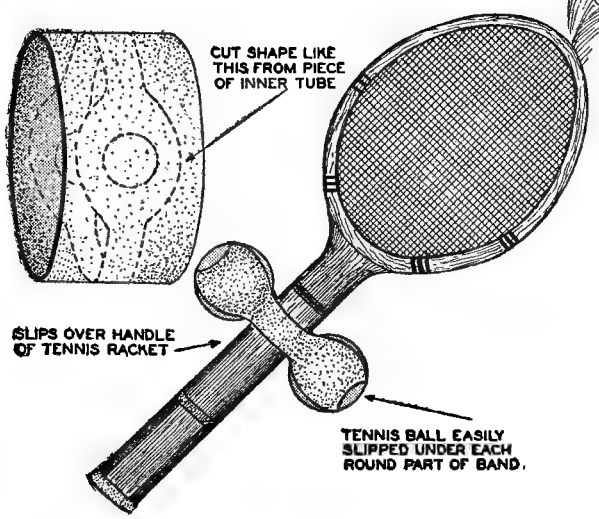
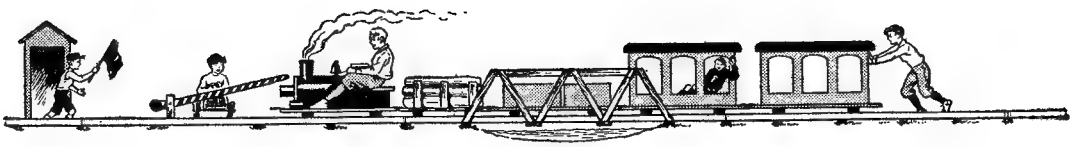


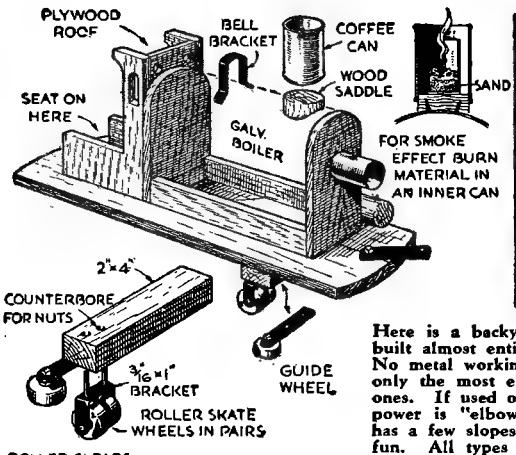


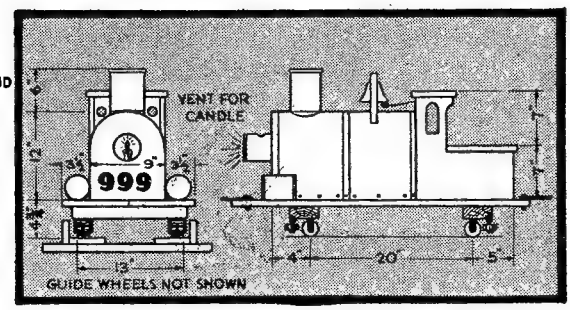
Jig For Tennis Balls

A CLEVER and useful gadget for carrying a couple of tennis balls right on the racket's handle is illustrated at left. From a segment of old inner tube a piece to the shape of the dotted lines is cut, approximately one-half inch wide at the narrowest part. The center part is clipped out on each side, leaving a hole. The band thus formed may be slipped over the handle of the racket and a tennis ball inserted in each side, where it will be held securely—*A. H. W.*

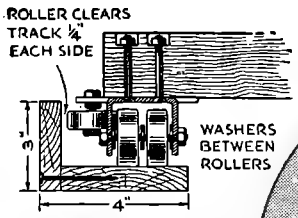


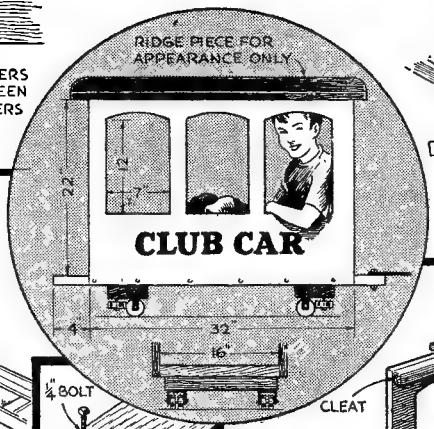
THE TIN CAN LIMITED

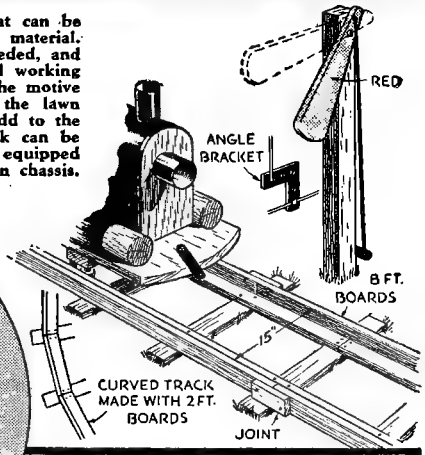


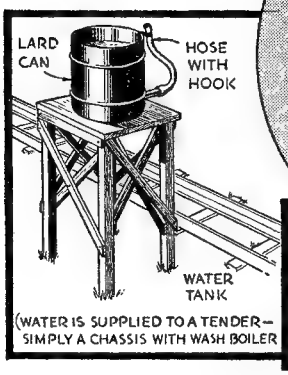


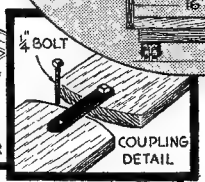
Here is a backyard railway that can be built almost entirely of cast-off material. No metal working tools are needed, and only the most elementary wood working ones. If used on a flat lawn the motive power is "elbow grease". If the lawn has a few slopes, gravity can add to the fun. All types of rolling stock can be duplicated in miniature and equipped with this simple type low-friction chassis.

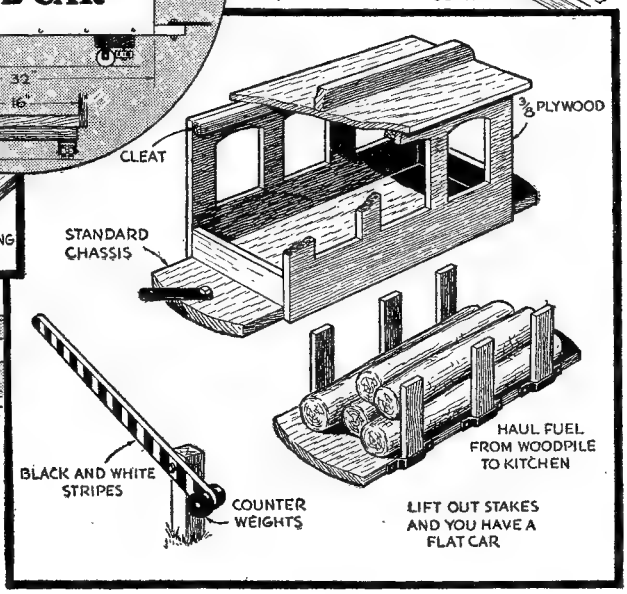


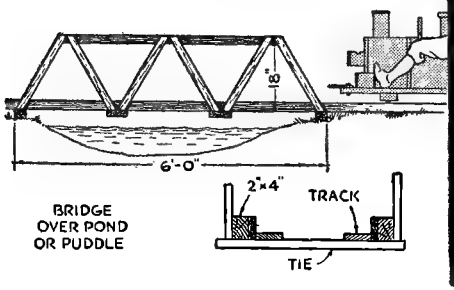


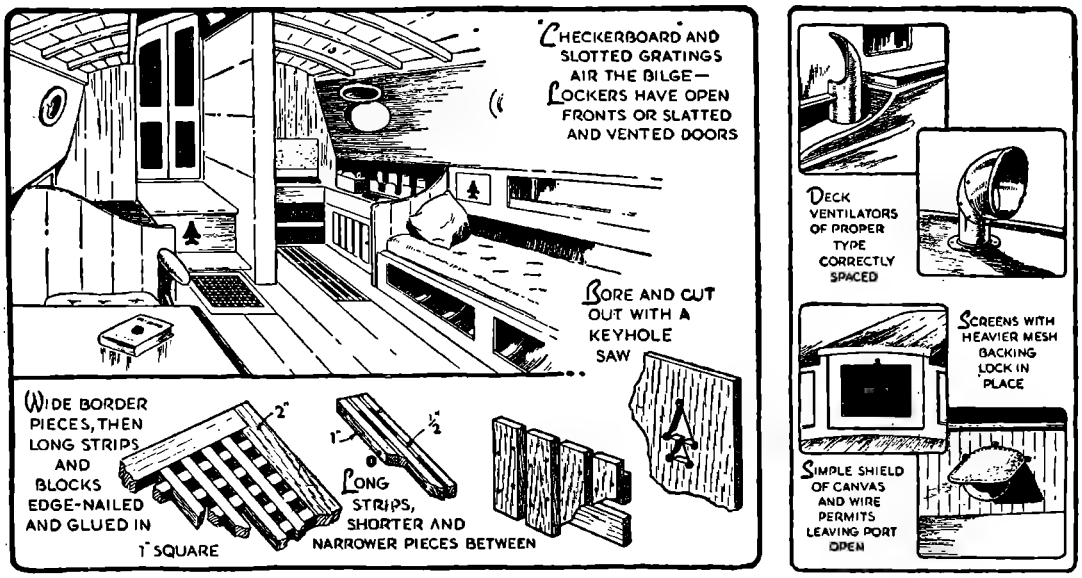












Proper bilge and locker ventilation help keep the hull sound. If your boat is not used during the week you should allow for air circulation through the cabin. A simple canvas shield over an open porthole will often do the trick.

Make Your Boat Last Longer

[*Continued from page* 81]

faces, preserves, protects and lengthens the life of wood and canvas.

Throughout the year follow procedures and apply remedies experienced boatmen find worth while. If any portion of the hull lacks ventilation plan some way to get air to it. This applies to those open boats having closed-in side and end lockers, and floor boards, as well as to cabin boats. You may merely have to bore holes in locker fronts and doors, or substitute slatted doors for solid ones. If holes are bored some distinctive design may be cut out from them to give a fair-sized but not unsightly opening. Bilge ventilation is important, as dead air gathers low down and is apt to start rot in important and expensive to replace main construction members. Center floor boards may be made loose fitting so they can be lifted out when the boat is left during the week. Particularly if the floor is linoleum covered arrange for a ventilating hatch having a neat brass binding so air can get not only to the main hull members but to the underside of the floor boards which, when covered, often rot out. Better still fit a small grating in the floor forward and another aft. These may be metal grilles or removable sections of flooring made up with slotted or square openings. If you have reason to believe the space right up in the bow, and that back under the after deck is not thoroughly aired, install suitable deck ventilators over these points, preferably choosing ones that can be left open without rain getting in. Along with this plan other ways to get fresh air into the boat during the week when it is kept closed or locked up. Even a simple canvas shield over one or two of the ports will permit leaving them open without rain getting in to do damage. Or a screen may be made for the companionway doors, perhaps with a backing of stouter mesh or rods, in locations where boats are apt to be tampered with, and this arranged to lock.

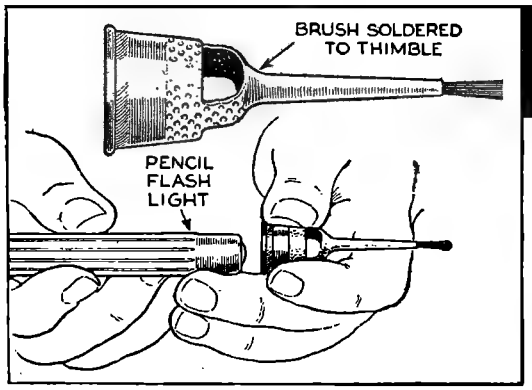
Watch for deck leaks—most carefully for those not apt to be a present nuisance. For instance, a leak over a berth is always traced and stopped whereas one back under a side or after deck may be neglected because it drips seemingly harmlessly into the bilge. The former may damage upholstery but the latter do more actual harm over a long period. Rain water coming through such a place usually follows along some deck beam until it lodges on or drips off an important fore and aft member. This fresh water and dead air forms a perfect combination to rot out wood and make expensive replacement necessary, because such places are seldom detected until damage is well advanced. Check up on these with a flashlight some rainy day.

Check just as carefully places where rain water may lodge but not come through. For instance, a coaming may not be tightly in place; rain drives in and lodges there. Or in a sailboat rain may come through the deck to lie on top of a mast partner or main deck beam. These members will rot out in time unless the opening is filled or other means taken to stop the leak. Even hairline cracks which apparantly do not leak through should be filled before painting as paint alone seldom enters such places. This applies to small as well as large boats.

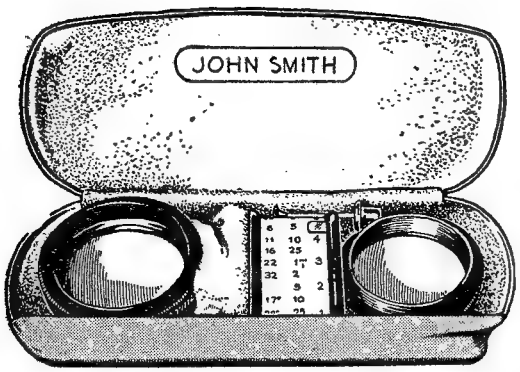
If you find evidence of rot do not hesitate to go after it. There is nothing you can do to give the

[*Continued on page* 143]

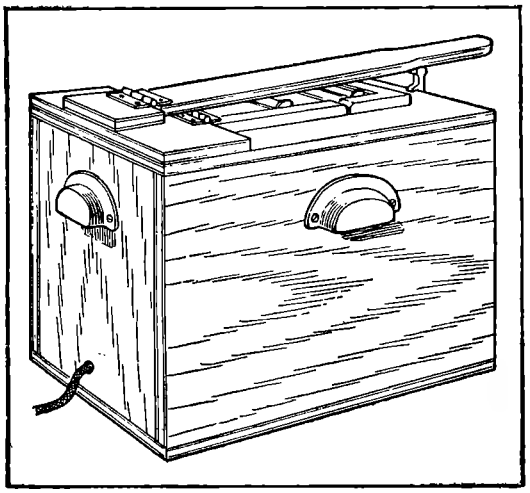
Photo Kinks



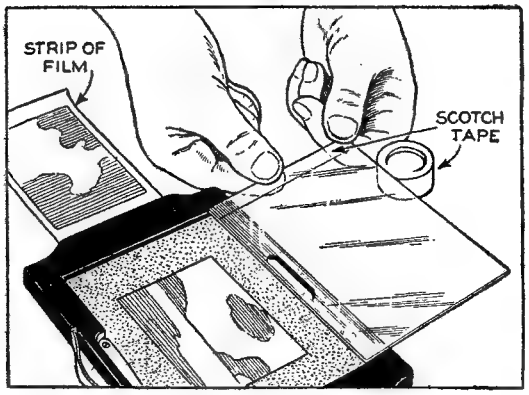
Above: Illuminated Dust Brush made from a sewing thimble and a pocket flash light. Cut off an artist's brush at the metal ferrule and solder to the thimble. Sides of the thimble are cut away as shown in the drawing. The thimble-brush assembly is now slipped over the end of a vest pocket flash-light. Pressing the button on the flashlight sends rays of light through the cutaway sections of the thimble-brush unit.



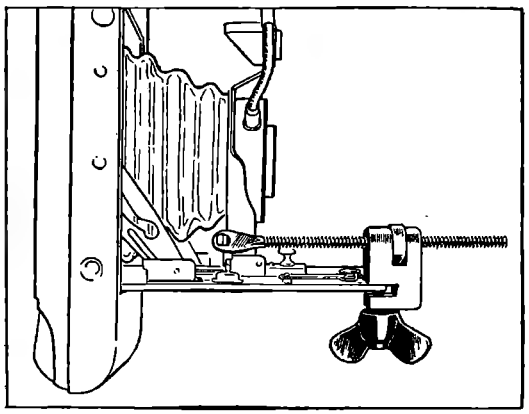
Above: Eye glass case holds camera accessories. These hard, inexpensive cases are available in dime stores and are convenient for carrying filters, cable release, sun shade, etc.



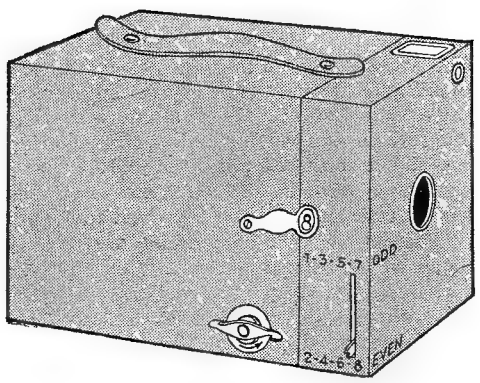
Above: Drawer pulls make good light traps. Available in dime stores, these drawer pulls can be used over ventilating outlets on printers, etc., as efficient light traps.



Above: Scotch tape prevents scratches. An uncut strip of film can be safely drawn through the negative carrier frame if edges of the glass are covered with tape as shown.



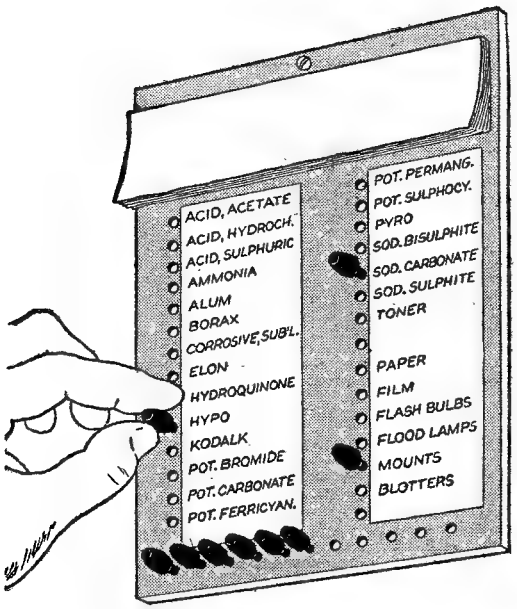
Above: Micrometer focusing for enlarger or camera can be achieved by adapting an accessory as shown. The long screw and racking knob can be assembled from old parts.



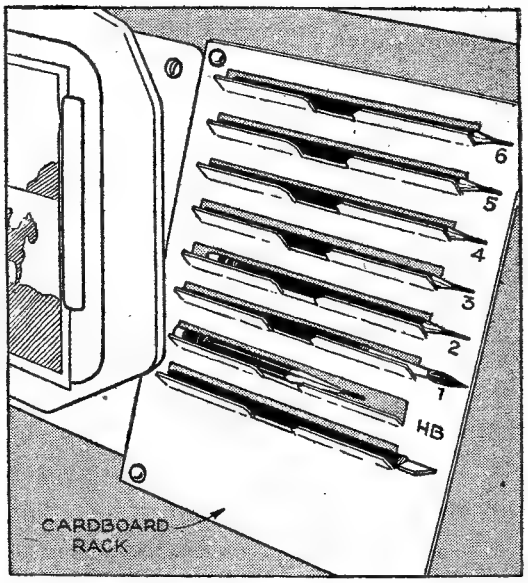
Above: Exposure reminder for box camera. Mark the top and bottom of the trigger slot "odd" and "even." Start roll of film with trigger at "odd" end of slot. Trigger number must correspond to number of film, if double exposures are to be avoided.

For Camera Fans

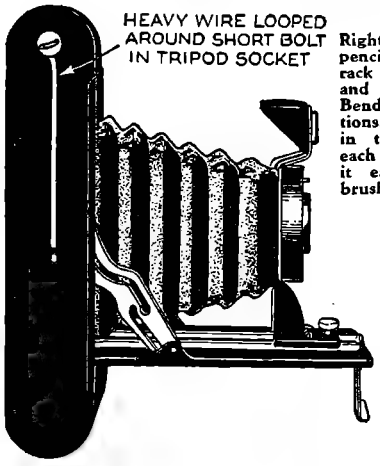
Below: A darkroom supplies memo is made by drilling holes in plywood, as shown. Names of chemicals are lettered on paper and posted on the board. Small pegs cut from a dowell stick serve as reminders when supplies are low.



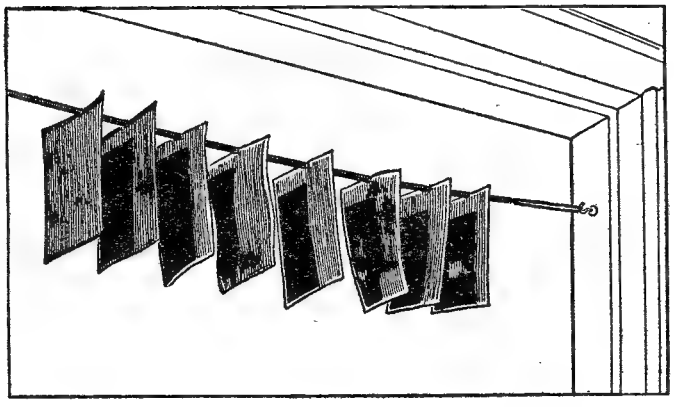
Above: Vinegar cleans trays. Dilute 1:1 with water and pour enough solution in tray to cover bottom. Then rub with a soft cloth until stains disappear. Acetic acid also serves.



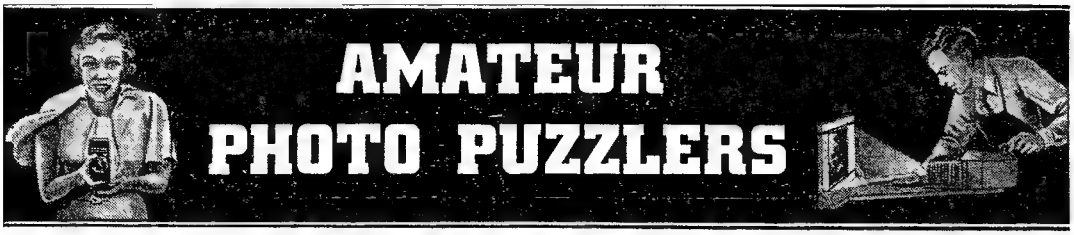
Right: Rack for pencils. Make the rack of cardboard and cut as shown. Bend out cut sections. A slot cut in the center of each "shelf" makes it easy to grasp brush or pencil.



Above: A simple camera level can be made from heavy wire looped around a short bolt in the tripod socket. Place a mark on the side of the camera to indicate dead center position.



Right: Curtain spring for film hanging. Use a strong, taut, spring steel curtain spring for drying film. Spring tension holds film safely.



1. SPOTS ON FILM

Q. In developing my film, I notice there are a few water spots on the negative. What could I do to prevent their appearance?—Peter Klimishin, South Bend, Ind.

A. The water spots referred to are probably due to incorrect development of your film. In fact, small semi-transparent spots on negatives are not water spots at all but spots caused by the presence of scum in the developer. Scum (usually metallic scum from the chemicals used) adheres to the film and prevents full action of the chemicals on the film surface. As a preventive, filter the developer each time *before* using. Air bubbles on a negative will also keep the chemicals from acting on the emulsion and result in spots. When spots are transparent, they are usually due to the presence of dust on the film or to some floating particle on the developer that comes to rest on the film. Dust spots cause pin holes which are round and transparent and should not be confused with scum marks which are semi-transparent.

2. DILUTING LIQUIDS

Q. I seem to be a bit confused on the arithmetical problem of diluting liquids. What's a positive rule to go by?—D. Ernhardt, Chicago, Ill.

A. When diluting liquid a definite number of times, follow this rule: Assume that dilution is to be three times: two volumes of water (not 3) should be added, since two volumes of water plus one volume of liquid makes three volumes, and the solution is three times as dilute as the first. For instance, a formula may call for 28% acetic acid where only glacial (99%) acetic acid is available. Since 99% is 3.53 times as strong as 28% acid. to make it 3.53 times as dilute, enough water must be added to 1 part of glacial acetic acid to make 3.53 parts of the 28% acetic acid, or 2.35 parts of water are added.

Now let us assume that you want to make a 10% solution of potassium bromide. This is done by dissolving 10 grams into a little water and adding water up to 100 cc. When mixing chemicals there should be no confusion between units of volume and units of weight.

3. BLURRED ENLARGEMENTS

Q. I am experiencing difficulty in my enlargements in that the edges are blurred. I use a 100-watt bulb and an opal diffusion glass. Have these anything to do with the fault?—Earl Saner, Salpulpa, Okla.

A. The intensity of the light or the use of an opal diffusion glass is not the cause of the blurred edges of which you complain. The intensity of the light does effect the tone quality of the print, and the condition of the opal glass serves to give more or less even diffusion of light. The blurred condition is more likely due to the lens. A lens with a short focal length insufficient to cover the negative will result in blurred edges in the print. A lens of poor quality optical glass, insufficiently corrected, will also cause blurred edges. The minimum focal length of the enlarging lens should be equal to the diagonal of the film being enlarged and the lens should be astigmatically corrected for best results.

4. OVERSIZE CONDENSERS

Q. I wish to use a 3½-in. condenser in my enlarger with a 2-in. lens. What will be the effect of this combination?—Irvin Musser, Orrville, Ohio.

A. Condensers serve to concentrate the rays of light from the lamp housing within the area of the negative and focal length of the lens. Naturally, 3½-in. condensers will spread the light for a greater area than would 2-in. condensers. That means a less efficient concentration of light—which is no serious handicap.

5. "F" RATINGS FOR CLOSE-UPS

Q. I've noticed that there is a change in the lighting quality or the ability of the lens to transmit light when working up closely to a subject with an extension bellows camera. Is there any set factor by which to calibrate the necessary change in exposure?—Leonard Wolfe, Nashville, Tenn.

A. When taking close-ups the lighting factor changes as the lens is brought near the subject. Close-ups nearer than 15 times the focal length of the lens require a correction. The stop markings on the lens apply, in theory, to infinity only. On approaching twice the focal length of the lens for photographing a subject to natural size, the stop should be two stops smaller than normal. According to this rule, f-8, becomes f-16. When taking a meter reading and the meter calls for f-8, set the lens at f-4, or quadruple the time at f-8.

6. GLOSSARY FOR CHEMICALS

Acetone (C_3H_6O): A solvent of celluloid. Used in the manufacture of film cement. Transparent and quick-sealing.

Acetic acid ($HC_2H_3O_2$) 28%: This is a weak acid generally used as a stop bath between developer and fixing bath. It has a strong odor of vinegar. For diluting glacial acetic acid, see the recommendations above in question No. 2. When using as a stop bath, add 1½ ozs. of 28% acetic to 32 ozs. of water.

Acetic (glacial): This is a 99% concentrate of acetic acid. It should be used in diluted form only as it will dissolve gelatin and celluloid.

Boric Acid (H_3BO_3): Used in fine grain developers as a buffer.

BIBLIOGRAPHY

Questions asked on this page have frequently been discussed at greater length in articles that have appeared in this magazine or in other publications published by Fawcett Publications. Henceforth, questions will be numbered. Corresponding numbers will be given below together with references to the articles, publications and page numbers in which the particular subjects have been discussed, if at all. This will enable readers to compile an extensive and valuable reference library on photographic technique not otherwise possible. The reference publications are all available from Fawcett Publications, Inc., Greenwich, Conn. Reference issues of Mechanix Illustrated are 15 cents postpaid. Reference issues of other publications are 50 cents each, postpaid.

1. **Spots on Film. See "Don't Stand for Stains," Photography Handbook No. 6.**
2. **Diluting Liquids. No reference.**
3. **Blurred Enlargements. See "Enlarging Made Easy," Good Photography No. 2, page 104.**
4. **Oversize Condensers. No reference.**
5. **"F" Ratings for Close-Ups. See "How to Make Copies," Photography Handbook No. 4, page 124. Also see "Close-Ups With a Front Lens," Photography Handbook No. 5, page 92.**
6. **Glossary for Chemicals. No reference.**

USES FOR ABRASIVES IN THE SHOP

A FEW ounces of pulverized silicon carbide (carborundum) and aluminum oxide will increase greatly the scope of your shop. In addition to their usual uses for charging polishing wheels and laps, abrasive powders and grains can be used for jobs not easily done in other ways. The finest powders, such as FFF, mixed with oil or water, make an excellent rubbing compounds for smoothing sprayed lacquer and similar surfaces.

To make ground glass for camera backs, light diffusers, etc., mix some abrasive grains with water, and rub this over the glass with a block of steel or iron. Use a grain of the proper size for the texture desired. To make decorative "frosted" or "spotted" designs similar to those seen on the works of watches and on fine instruments and tools, glue a disc of leather or felt to the end of a 4-in. length of dowel or a steel rod, charge the disc with some fine abrasive powder (such as FFF) mixed with oil, and rotate it against the work with

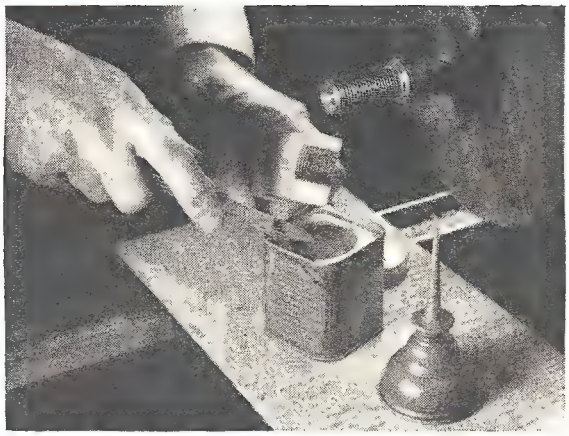
[*Continued on page* 121]

Drilling hole in glass plate with a brass tube as a bit and No. 80 silicon carbide grains moistened with turpentine, as a cutting agent.

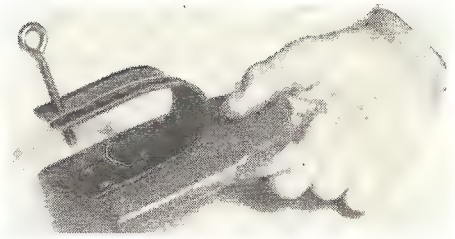
Lower Right: Rubbing down sprayed lacquer with fine abrasive powder mixed with water.

Below: Using a brush and abrasive grains to produce a satin or French gray finish on polished metal. The brush can be manipulated in various ways to produce different effects.

Below: Polishing threaded work on a lathe with abrasive grains or powder applied with a soft pine stick. The end of the stick, which preferably should be hollowed to fit the threads roughly, is pressed against the work until the threads cut grooves in the wood. Then the abrasive, moistened with oil, is applied to the stick.



Detachable Shelves



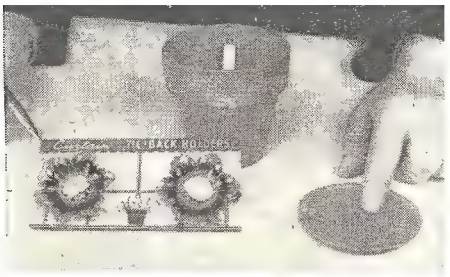
HANDY little detachable shelves that have a multitude of uses can be made of scrap lumber and homemade C-clamps. The clamp is a piece of iron of suitable size, drilled and bent as illustrated, and screwed to the underside of the shelf.

Suggested uses: On the crossbars of windows where small plants will get maximum sunlight; on the edge of a table, desk, or arm of a chair, to hold an ash tray or drinking glass; or on a ledge in the bathroom for the tooth-glass or on any similar projection. In places where a long eye-bolt, as in the photo, would be conspicuous, use a shorter machine screw.

A novel use for the idea is to make a set of four shelves shaped like the spots on playing cards, painting the heart and diamond red and the club and spade black. These are

used on a bridge table and hold ash trays, cigarettes, matches, glasses, lighter, pipes, etc., which otherwise encumber the table. The clamp in the illustration is ornamented with a strip of brass.—*Bertram Brownold.*

Flower Pot Cigarette Humidor—Ash Tray



THIS attractive and amusing novelty can be made cheaply and easily from materials secured from any local five and ten.

In the photo at left we have a small clay flower pot, 3½-in. high, a pair of curtain tie-back holders consisting of two metal flowers, decorated to simulate nature. Both the "flowers" are mounted on a small piece of dowel stick about ½-in. in height. Save these as they are part of the construction. The other object in the picture is a Bakelite coaster, normally used to prevent droplets of water from dripping on a table surface.

Remove one of the metal flowers and the wood dowel stick from the card, center the

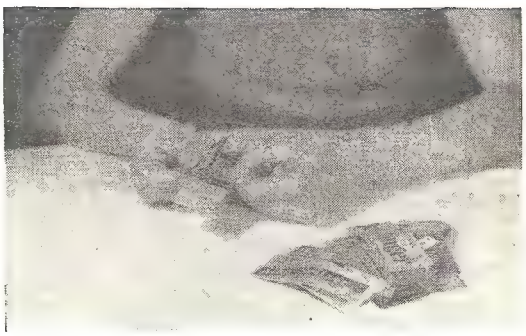
[*Continued on page* 122]

Make Colorful Ash Tray Holders and Flower Pot Stands from Match Covers

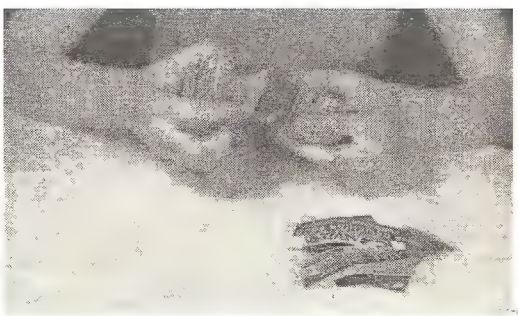
BELOW: The first step is to flatten out the covers and cut off the striking surfaces. Because of their great variety of color and design these paper match covers are very attractive when linked together.

Start the holder by laying one book match cover over another, plain side up, to form a cross. Fold the projecting edges of the lower cover down as shown in photo below. . . .

Lay the next cover over this fold, plain side up, to form a cross as before, and fold down the projecting edges of the lower cover. Repeat this process until you have built up the holder to about 20-in. At this point the holder should be bent in a circle.



When the desired size has been obtained, the ends of the holder are connected simply by inserting the two remaining flaps into the opposite end as shown. The holder is thus automatically locked together. A couple of its uses are pictured at top of page.



Your Job—Drafting

[*Continued from page* 71]

its demands upon its followers, the rewards can be proportionate. It would be hard to find an occupation which offers richer or more varied opportunities for real success. When you start as a tracer, you can expect from $18 to $22 a week. The next step is detailer, at $30 to $40 a week. To win this assignment, you need not only to have proved your ability at mechanical drawing, but also need a thorough mastery of physics and mathematics. After making good as a detailer, your next promotion will be to draftsman and designer and your income will range from $200 a month to $5,000 a year.

By the time you reach that stage you will probably have become a specialist. You must know, besides drawing, some specific field—structural or machine or marine or other type of designing. This specialization will develop out of your own leanings and the requirements of the industry you grow up with.

Income Chart for DRAFTSMAN

Tracer, per week	$18 to $22
Detailer or junior draftsman (thorough knowledge of physics and mathematics required) per week	$30 to $40
Draftsman and designer, per month	$200 up
Skilled draftsmen make yearly salaries as high as	$5,000

After you reach that point, the sky's the limit. The Chryslers and Ketterings and Steinmetzes of industry are men who read blueprints like a Wall Street man reads a bank statement. Most of them could pinch-hit for any draftsman on their staff because most of them served their stint in the drafting room.

One of the things about drafting which warms the cockles of your heart is the way it throws you into association with important men. Even if you are only a tracer, it's *your* work that the big boss sees when he studies a finished blueprint, for you inked in the drawing from which the print was made. He *sees* that you turned out a neat, accurate job. Or a botched, inaccurate one. The point is, you aren't buried. There's no dead end in drafting.

As a detailer or designer, you'll sit in on conferences when new projects are taking shape. Your opinions and suggestions will be requested. You can make yourself felt, if you have the stuff. A big drafting room is a school of cooperation as well as of individual effort.

That's why certain qualities of personality, such as the ability to take directions, to get along well with others, to do teamwork, are included in the aptitude test. Drafting, like any other profession, contains hundreds of men who have reached a certain point and then stopped. They are unable to spring from a good drafting job into an even better executive spot. Hundreds of others do make that grade. You can be taught mechanical drawing, but you can't be taught any basic alterations in character. A draftsman's diploma is no magic key to success—there isn't any such key—but it's a tool which can carry you plenty far if you keep it working.

Now that you understand pretty well what a draftsman does, and, we hope, how your own qualifications stack up with those that are required, let's analyze the assets and liabilities of the vocation.

The disadvantages are principally that it is a sedentary occupation and makes pretty heavy demands on vision. Competition gets steadily keener with the result that more and more technical preparation is demanded of the beginner. Opportunities tend to be centralized in large industrial areas, 80% of all draftsmen being employed in the northern area between the Atlantic and the Mississippi. You may not be able to find a suitable drafting job in your home community, if it is small.

Balancing these liabilities is the fact that a competent draftsman is as assured of steady work as any man can be. Every factory needs draftsmen. Even in depressions, the draftsman doesn't run great risk of being laid off because it is then that corporations buckle down to planning new products or improvements and they can't get to first base without draftsmen to interpret them.

More important, you work with your head as well as your hands so your experience becomes more valuable with the years. It is the laborer, not the head-worker, who is old at forty. You will become a specialist in structural or machine or other types of drafting as the years roll on, and this will make your experience more valuable.

The occupation is a foundation for engineering profession if you choose to advance in those fields. The physical labor of drafting is easy; it is a "white collar" job, and it is highly regarded by the community.

The 1940 census, now under way, will unquestionably reveal a substantial increase in the number of draftsmen in the country. The last figures available are from the 1930 census, showing 78,439 persons employed as draftsmen. This is about 2½ times the number employed in 1910, and our civilization is even more mechanized now than it was ten years ago.

"How does one become a draftsman?" is the next question you have undoubtedly arrived at.

Broadly speaking, there are three ways: by apprenticeship in a drafting room, by college or technical school training, or by correspondence study.

[*Continued on page* 120]

KNOWLEDGE
THAT HAS
ENDURED WITH THE
PYRAMIDS

A SECRET METHOD FOR THE MASTERY OF LIFE

WHENCE came the knowledge that built the Pyramids and the mighty Temples of the Pharaohs? Civilization began in the Nile Valley centuries ago. Where did its first builders acquire their astounding wisdom that started man on his upward climb? Beginning with naught they overcame nature's forces and gave the world its first sciences and arts. Did their knowledge come from a race now submerged beneath the sea, or were they touched with Infinite inspiration? From what concealed source came the wisdom that produced such characters as Amenhotep IV, Leonardo da Vinci, Isaac Newton, and a host of others?

Today it is known that they discovered and learned to interpret certain *Secret Methods* for the development of their inner power of mind. They learned to command the inner forces within their own beings, and to master life. This secret art of living has been preserved and handed down throughout the ages. Today it is extended to those who dare to use its profound principles to meet and solve the problems of life in these complex times.

AMENHOTEP IV
Founder of Egypt's
Mystery Schools

This Sealed Book—FREE

Has life brought you that personal satisfaction, the sense of achievement and happiness that you desire? If not, it is your duty to yourself to learn about this rational method of applying natural laws for the mastery of life. To the thoughtful person it is obvious that everyone cannot be entrusted with an intimate knowledge of the mysteries of life, for everyone is not capable of properly using it. But if you are one of those possessed of a true desire to forge ahead and wish to make use of the subtle influences of life, the Rosicrucians (not a religious organization) will send you A Sealed Book of explanation without obligation. This Sealed Book tells how you, in the privacy of your own home, without interference with your personal affairs or manner of living, may receive these secret teachings. Not weird or strange practices, but a rational application of the basic laws of life. Use the coupon, and obtain your complimentary copy.

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The ROSICRUCIANS
SAN JOSE (AMORC) CALIFORNIA

Your Job—Drafting

[*Continued from page* 118]

Some corporations maintain their own training schools, affording a method of getting paid while you learn. If you have a leaning toward some particular branch of drafting—airplane engine design, for instance—you will do well to make inquiries in the field and you may find a company that will accept you for training. This is not the usual practice, however, for the majority of employers do not care to take on green hands. This attitude may be a reflection of the fact that currently there are many graduate engineers to choose from, owing to the increased output of colleges.

In your own community, if it is of fair size, there may be colleges or technical schools with excellent courses in drafting. Inquiry at your local Board of Education offices will give you information on such courses and the costs of tuition, as well as entry requirements. Since all of these factors show wide variance, it is impractical to list them here.

Of all subjects taught by correspondence, drafting is the best suited to this method. As we have already seen, drafting is "paper work" and that is essentially the method of correspondence study. Where correspondence training is of doubtful benefit in becoming an airplane pilot, as we observed in the April issue, it is excellently adapted to drafting and design study because of the nature of the occupation.

The average time required to complete a drafting and design course by correspondence is three years, or 1,200 study hours. One such course costs $147, another $180, covering all subjects necessary for men who wish to adopt drafting as a profession. Another mechanical drawing course with mathematics enough to qualify you as a practical draftsman costs $155. A course with enough mathematics and mechanical drawing to enable you to "speak the language" and read blueprints, without polishing off your technique of making complicated drawings, costs $85 to $90.

We have said you have to take to mathematics like a candidate to a baby, and a listing of subjects included in both mechanical drawing, and drafting and design courses, will speedily prove it. Here they are: arithmetic, elements of algebra, logarithms, geometry and trigonometry, geometrical drawing. In a mechanical drawing course you get, in addition to these and to the main subject, elements of projection drawing and machine sketching. In the draftsman's course you will add such subjects as link mechanisms, gearing, pulleys and belting, elementary chemistry, strength and testing of materials, and machine design. If any of those sound like bad medicine to you (they sound like work in anybody's language, and they *are* work) you can drop the drafting idea while there's still time. In return for its rewards, the career demands plenty of good old-fashioned brain sweat.

Look into the method of training which most appeals to you. If you sign on as an apprentice, you'll earn money while you learn but it won't be a great deal and unless you go ahead unusually fast you will have to invest about three years of your time at the job. If you study in spare time, you won't get paid for drafting but you will probably have a daytime job and you may be farther ahead in the long run by drawing down a draftsman's wages when you have completed your course.

All of these are factors which, being a level-headed sort with a practical draftsman's mind, you are well equipped to decide for yourself. It is ordinary good sense to weigh carefully in the light of your own needs the advantages that different schools or different training methods may offer you.

Once you have your draftsman's diploma, the big task remaining is to get a job. If you have learned your stuff in a drafting room, your problem is simplified—you simply go ahead where you are. If you have taken a correspondence course, your school very probably maintains an employment service which may put you in touch with just the right job for you. Trade schools frequently have such services too; in fact, institutions training draftsmen are logical sources for an employer to turn to when he wants men he can depend upon. One large school reports that it is easier to place draftsmen, or beginners in drafting, than it is students of any other technical job.

Help wanted columns in newspapers in industrial cities ordinarily have more ads for draftsmen than for other specialized vocations. To hold down a job once you've landed it you have to be good, for since everything you know shows up on paper there's no concealing it. The practical advantages of choosing some special field and sticking to it are obvious. Drafting, for instance, is an effective passkey into the attractive field of aviation, recently discussed in this series.

One disadvantage of drafting, if you are an individualist, is that there is very little opportunity of going into business on your own, as you can if you are a photographer or radio service man. It is true that some draftsmen make a good living as free lances, but generally speaking you will have to go to work for a corporation or a small employer. By combining drafting with other engineering knowledge, such as architecture, you may be able to set up shop successfully.

But the typical draftsman, though able to stand on his own feet and accept responsibility, is a teamworker by nature, for large projects these days aren't completed by a single man. An automobile represents the combined drafting labors of thousands of men. If you are cut out for the job

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Your Job—Drafting

[*Continued from page* 120]

you would probably rather go to work for a corporation than hang out your own shingle.

There isn't much glamour in drafting, but it's a million-dollar feeling when you see a new skyscraper going up, or a shimmering bridge flung across a river, and you say to yourself as you watch the sparks fly, "You bet those rivets fit, because I showed 'em where to put 'em!"

ATTENTION, MI READERS!

This article is the sixth of the MECHANIX ILLUSTRATED vocational series which began with the January, 1940, issue. In the event that you have missed one or more of the articles, the schedule given below will tell you what vocations have already been covered. Copies of the issues below may be obtained for 10 cents each from Fawcett Publications, Greenwich, Connecticut.

January ..... Auto Mechanic
February ..... Radio Servicing
March ..... Photography
April ..... Aviation (Flying)
May ..... Aviation Mechanic

The July issue will cover the vocation of Mechanical Engineering.

Uses For Abrasives In Shop

[*Continued from page* 115]

a drill press or hand drill. Overlapping the disc-shaped marks thus produced results in the design.

Fairly coarse abrasive grains, such as No. 80 silicon carbide, mixed with turpentine, can be used for drilling holes in glass, porcelain and similar hard materials. For small holes, use a brass or steel rod as a bit; for larger holes use a tube. Drive these preferably with a drill press run at low speed.

A 1-in. paint brush whose bristles are charged with abrasive powder can be used to produce attractive satin or French gray finishes on polished brass, copper, pewter, silver and other metals. Dip the dry brush in the abrasive powder, and rub or "stipple" the metal with it. Paper stencils glued temporarily to the metal to protect certain areas can be used to produce attractive designs.

After cutting threads with a lathe, you can polish them as follows: Press the end of a soft pine stick against the threads to groove the wood; then charge the end of the stick with abrasive powder and oil, and use it as a tool for polishing the threads.

Many other ways of using pulverized abrasives will suggest themselves. Usually either silicon carbide or aluminum oxide can be used with equal success. For average needs, three or four grain sizes are enough, say Nos. 80, 100, 150 and FFF, 80 being the coarsest and FFF the finest.—*Walter E. Burton.*

Highest voltage X-ray tubes yet made are turned out for the National Bureau of Standards: one use will be measuring X-ray dosage for medical purposes.

Cut Yourself A Chord Of Cake

[*Continued from page* 41]

plate, where it is secured with a light wire staple.

At the highest point the thread rises three-quarters of an inch. It is easily severed when a knife is inserted in a cake at a point, plainly marked in red on the rim of the plate, approximately one inch from the lever.

With an inch leeway on either side of the red mark the thread will be cut and the musical mechanism set in motion by even the poorest of "shots." Since, however, the second insertion of a knife will invariably be to the right of the first, in counterclockwise fashion, there is double insurance that the controlling thread will meet the knife.

When the music has been installed the edible part of "Musicake" is arranged. A hole large enough to accommodate the musical box is stamped out on a fresh "layer" and the "layer" set around it. A thin slice of the stamped out portion is wedged under the controlling thread to give it support and prevent sagging. Although a cake's ingredients would not be adversely affected by the metal cover of the box a paper cup is set over it in order to meet the requirements of some unusual laws of a few States.

Over this first "layer" some kind of fruit filling will then be spread. Even before the top "layer" is added and the whole coated with a medium heavy, butter cream frosting the music part of "Musicake" is well concealed.

It is now ready to receive Carl Segren's art or that of either of the two cartoonists he employs when orders are heavy. On the surface of the cake Carl will reproduce any one of the several thousand in a stock book of cuts or he will follow the lines of any design or personal photograph that may be submitted.

"Make it funny" is a regular command and Carl is frequently called upon to provide a punch line of his own creation.

"Have two men sitting at a desk. One is bald, with two hairs standing up. The other has gray hair. Have him say 'Well, billiard ball' or something funny like that."

"Let a Scotchman be painting a sign. Let the sign read 'Happy Anniversaries to Harry and Emma, Louie and Ann, Joe and Helen. Happy Birthdays to Dave, Hannah, Sarah and Eddie.'"

Carl gives his customers what they want. A first-class cartoonist, he makes his figures without any preliminary outline or motions. His brush is a small, triangular piece of cellophane rolled into a cone and snipped off at the end. His paint is the tenacious Agar jelly in green, yellow, red and clear colors. While the jelly easily hardens it will not readily chip or break.

So expert has Carl become in wielding his "brush" that he can reproduce a verse of 60 words on 2 square inches of cake space. Some of these verses are of his own composition. His lettering, large or small, has the mark of the professional.

Carl's mother was endowed with some artistic ability but never developed it to any degree. His grandfather was a successful commercial artist. Carl himself served a brief apprenticeship as a show card writer at two dollars a week, following his graduation from New Utrecht High School, in Brooklyn.

As the line of least resistance, by his own admission, he eventually went to work in his father's bakery. Thure Segren, in business 30 years, believed that a good baker was one who, like himself, excelled in the baking of good bread and rolls. With this in mind, Carl was sent to a school in Chicago to take a primary course in bread baking.

On completing his studies he returned to Brooklyn with little or no interest in the baking of bread and rolls. Instead, he turned his attention to the plain cakes that were the by-product and not the basis of his father's business.

When first friends and later regular customers of the bakery expressed pleasure over the cartoons with which Carl ornamented their cakes he was encouraged to send out several hundred circulars announcing "Cartoon Cakes." After months of experimentation "Cartoon Cake" was finally "threaded for sound."

The success of "Musicake" is due, in the main, to its novel element of surprise. When a delicious looking cake, adorned with amusing cartoons and semi-humorous verse or inscriptions, suddenly and unexpectedly gives forth "Happy Birthday To You" or "Hail, Hail, The Gang's All Here," the effect is startlingly and pleasantly overwhelming.

About 90 "Musicakes" with the musical number of "God Save The King" were shipped to various sections of this country and Canada during the visit to these shores of England's King and Queen. The Roosevelts have had "Home On The Range" in several of Carl Segren's masterpieces. Many prominent men and women have been customers. Since "Musicake" is popularly priced at $3.50 and up, depending upon size and ornateness, its purchase has by no means been limited to people of means. The bulk of Carl's business is from folks of ordinary income.

Flower Pot Humidor

[*Continued from page* 116]

assembly (use Dupont Cement) on the coaster by drilling one small hole through it, and anchor it with a small screw. When finished the result should appear as in the center photo.

In use, the flower pot holds the cigarettes and the flowered top removes to form a useful ash tray, the petals used for flicking off the ashes.—*Herbert E. Hayden.*

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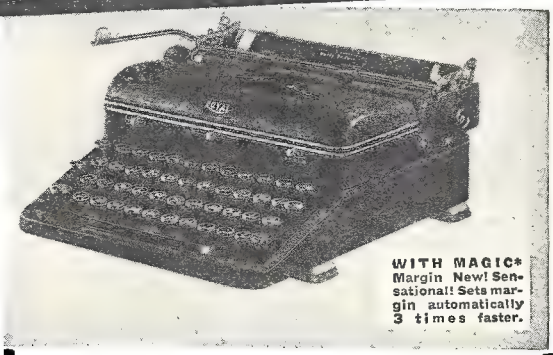
Use this NEW ROYAL Portable FREE

READ WHAT OWNERS SAY: "Earn more money—make that correspondence course pay real dividends" (Sales engineer) . . . "Get ahead faster—make home work count" (A student) . . . "A real help to everyone in the family." (Housewife)



SEND NO MONEY—don't spend a cent—until you *know* that a New Royal is going to be worth many times its cost to you. *Know* how easy it makes writing—how its many office typewriter features and controls help *you* turn out neat, accurate business-like letters and reports. Maybe you've never used a typewriter—never thought of owning one . . . Then you owe it to yourself, to your future, to clip the coupon *at once* and get the FACTS. No obligation.

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CITY _____ *COUNTY* _____ *STATE* _____

MAKE THAT OLD TYPEWRITER HELP PAY!

Please quote trade-in allowance on a _____ *Typewriter, Serial No.* _____

This Gadget Smells!

[*Continued from page* 39]

distances through transmission through ether waves. This machine is known as the radio. Sight is also transmitted through air by means of television. If two of the human senses can be transmitted, is it not logical to surmise that a third can be also transmitted?

The "Odor Wave Machine" was conceived in a strange but interesting fashion. Luther Shipman was raccoon hunting with a friend of his one night near Hendersonville, in Henderson County, North Carolina. But let Shipman tell the story: "The dawgs was wore out as my friend and me come to a apple orchard. My buddy said, 'Ain't likely to catch no coons tonight, too dry.' I tole him, 'I'm agoing to invent a machine that will ketch a coon wet or dry. Ain't nothin' a dawg can do, Ah cain't'."

Shipman did go home and several weeks later it was noticed that Shipman was finding more game than any one else in the county. He was able to locate any of the little fur-bearing animals and his stack of pelts began to grow in unprecedented fashion. His fame for finding game led to his fame for finding almost anything that was lost, but still the populace was sceptical when Shipman explained that he found these articles with his smelling machine.

Then one day a prominent dentist in the resort of Hendersonville was the victim of a theft and had four expensive guns stolen from him. The dentist had heard the remarkable rumors about the success of Shipman in locating lost articles. The dentist offered Luther a reward of twenty-five dollars if Shipman would locate the stolen guns. Luther manufactured a battery incorporating the "personal scent" of the dentist and combining that with "gun smell". He turned the dials and as the needle pointed almost due east, strode off in that direction. He trailed those guns for several days and then called the dentist and told him he had found the guns. He had, too. He had found the arms hidden under a wood-pile forty-three miles from his original starting point.

Firearms and animals are not the only items listed amoung Luther's successful tracings. A man had been drowned in the river in western North Carolina. The stream was in the mountains and therefore swift. However, it broadens into a lake at one point and it was thought that the body had settled in the lake. Searchers dragged the lake for three weeks and finally resorted to blasting without success. In desperation, Luther Shipman and his "Smell Machine" was called. First the inventor asked the family to obtain a pair of the drowned man's shoes, a well-worn pair. From these he made his by-now well-known battery and tuned his machine to the personal

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Mars Plays Hide And Seek!

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scrap metal in an open field. On the Western Front grassy knolls hide machine gun nests, brush heaps cover munitions dumps, and logs in forests are high-explosive mines.

Sometimes decoy and concealment are combined; a mile from a fake airfield may be the real base looking like a farm. I saw a superb use of this camouflage in England. To the uninformed observer it *was* a farm, with barns and haystacks and meadows. With a guide, however, you saw that barns were hangars and haystacks concealed smaller buildings, and that what seemed to be a ditch across the meadow, an obstacle which would wreck a plane striking it, was actually painted on the ground in the darker brown of shadowed earth.

The plane, which has given the camoufleur one more thing to hide, has complicated his life in other ways, too, because of aerial photography. Lens and film pick a living leaf from one on a dead branch used as camouflage, and differentiate between colors the eye accepts as identical, spotting, for instance, a green paint your eye says matches grass perfectly. It must be said here, however, that American Army engineers have beaten the camera in their laboratory at Fort Belvoir, Va. After discarding many colors, they found a greenish olive drab which could not be distinguished from natural greens at 5,000 feet and could not be spotted by a camera at 10,000. This new summer color for motorized units, however, is only the exception which proves the rule: the camera can see what the eye cannot.

This rule governs most behind-lines camouflage, where buildings must be hidden and paint is the best means.

Camoufleurs have a slight margin of safety, however. They know a 300-mile-an-hour bomber 15,000 feet up must fix on a target six miles away to bomb accurately, for it takes at least 45 seconds (four flying miles) to aim, and the bomb travels two miles forward in dropping from that height. Thus if a target is indistinct six miles off and three miles up the bomber must slow down or circle for another try. Either effect gives defense guns and planes more time to down the raider and lets people on the ground find safety.

The problem is tackled methodically. A factory on the edge of an English village, for example, is a target whether it makes shirts or shells. Experts asked to hide it first build a model of the plant and adjacent terrain on a scale of 1:200. After examination of aerial photographs, the model is placed on the floor at one end of a barn-like building. High at the other end (for this scale a perch 80 feet above the floor and 160 feet from the model affords the same view as is had by the crew of the bomber) experts study the model through a piece of sanded glass, giving the effect of horizon haze.

Having learned everything possible by observation, the experts attempt to blend the plant into the landscape, using paint to break up the regular pattern of buildings and tone them to surrounding houses and fields. Greens and browns match grassy areas and, used in large blotches, give an over-all bronze which approximates either winter or summer fields. Squares and stripes of red, brown and yellow suggest houses and streets, and purples and blacks give shadows and distort natural shade. The painted design should be bold, and must break the lines of roofs and corners. The surface must be non-reflecting; British Air Raid Prevention experts scatter brick dust on wet paint to insure this and dust a clear varnish on skylights to eliminate glare while retaining transparency.

As with the industrial area, paint is the only practical camouflage at sea today. "Battleship gray," approximating the color of sea, mist and horizon, was devised by Americans about 1902 after they had decided that the white warships used in the Spanish-American War were easy targets. Merchant ships use "disruptive coloration," technical term for the zebra-striped "dazzle" camouflage invented in the first World War to blur outlines of a ship so enemy torpedoes cannot be aimed accurately. In 1918 painters still used light colors for "dazzle" work at sea, but today dark tones are favored since they combine the concealment of warship coloring with the confusing effect of the earlier stripes and whirls.

There is progress at sea, too. The innocent but deadly Q-boats, for instance, seem to have passed from the scene now that any ship is a fair target. Replacing them in trickery afloat is the new U-boat habit of releasing oil when attacked. The oil patch indicates that the sub has been destroyed, so the attackers go away while the submarine remains quietly submerged until unwatched and then continues about its business. Since the history of camouflage has been to match trick with trick, we may next expect to hear that destroyers have found a way to appear to leave a scene, while actually they lie in wait for another move from their foe.

Scientists Take Tip From Hen

A new automatic egg-turning device in experimental incubators of the U. S. Department of Agriculture has decreased the death of chicks within the egg shell. The turning mechanism operates about every 15 minutes—the same interval of time at which a hen, on a nest, moves and turns the eggs. The hatch of fertile eggs has been increased 7% by the method.

About 425,000,000 pounds of cotton a year are required in making tires in the United States.

This Gadget Smells!

[*Continued from page* 123]

scent of the drowned man. Within thirty minutes, the 50-year-old inventor pointed to a spot in the lake and told the other member of the searching party, "He's doawn ther. Fifty-fiv' foot of water." A diving suit was rushed to the scene and when the diver went down, he discovered the body in the spot that Shipman indicated. The body was washed under a pile of brush that had held it securely in the bottom of the lake for the three weeks.

Shipman and his "Smelling Machine" have appeared in moving picture shorts, in newspaper feature stories and on coast to coast radio broadcasts. Many people are sceptical about the smeller and inclined to scoff. Maybe they are right. But three thousand people in western North Carolina and South Carolina will swear by Luther Shipman and his "Smelling Machine."

"Minute Men"

[*Continued from page* 51]

experts are locating them at points of greatest traffic danger, as shown by studies of local accident records. Thus from their statistics they have been able to predict, with surprising accuracy, the number of traffic crashes that will occur in a given territory within the year!

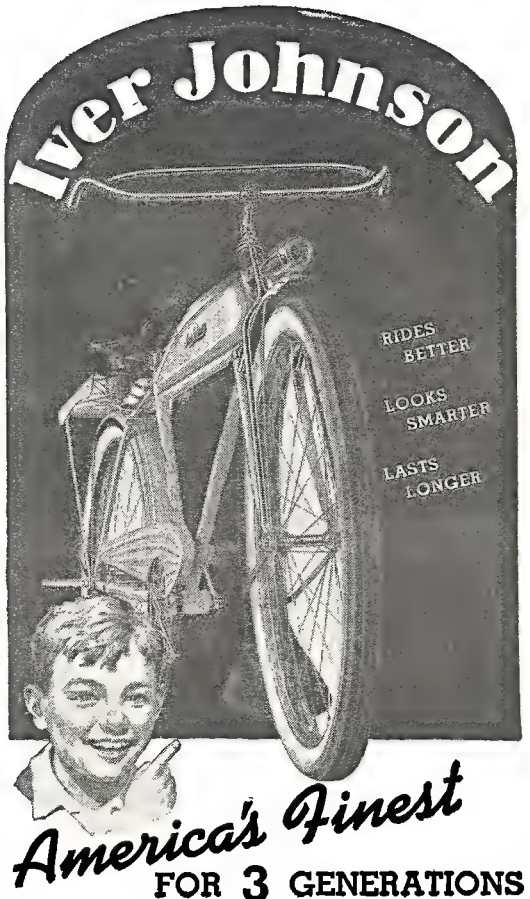
Strangely, tests have shown that the mere presence of the Red Cross sign itself slows down speeding traffic more than the conventional highway warning sign. At a point where two main highways intersect near Pine Bluff, Arkansas, there had been an average of an accident every six weeks—but after Red Cross signs marking a first aid station were erected there, sixteen months passed without a major accident. Finally it happened—a teamster drove directly into the path of a speeding automobile. But checking up, Fred Wigal, first aider at the station, found the reason the warning had failed. The teamster couldn't read!

Paid To Be Nosey!

[*Continued from page* 43]

which are sniffed for a few moments. On certain trains, the sniffers open a small window in the first car for a whiff of the tunnel air as the train rushes through; on others, they inhale on the small platform between cars. Sam Turner, who made good above the ground for Consolidated and was promoted down into the subway, reveals that he, in difficult cases, drapes his coat over his head as the train enters the station to exclude all other odors and because the gas, if any, clings to the wool of his coat for a few seconds making it easier to detect.

Once a year, the subway sniffers are tested with six unlabeled bottles—gasoline, peppermint, rose water, lemon oil, drip oil and ammonia.



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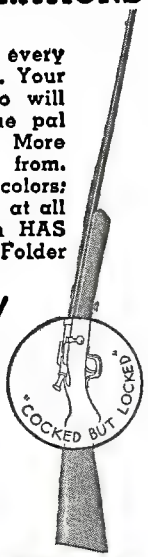

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Harry Atwood—Pioneer Of Plastic Planes

[*Continued from page 57*]

moulded in cylindrical form, would withstand was prodigious. In later experiments, the material was buried for a year in nests of termites, immersed for a like period in teredo-infested sea water. Neither of these wood-devouring creatures was able to get a tooth into the wood-plastic sheets.

Now, Harry Atwood was ready to build his second plastic airplane. He called in Professor Joseph Newell, of Massachusetts Institute of Technology, to assist him in design and construction.

Forms were constructed of shape and size for fuselage and wings and the wood ribbons, first dipped in liquid plastic, coating them but not filling the pores, were woven over the forms by workmen in a furniture factory, who didn't know the first thing about airplane construction. With sheets of thermoplastic laid over the woven structures, they were placed in heated metal moulds and pressure was applied.

Fulselage and tail were all in one piece; the wings were made in two sections, moulded together with honeycomb reinforcement inside. So light was the whole thing that a workman muscled the fuselage unit aloft without great effort.

It was a light craft and it looked good. Tests applied before the engine was installed proved that it was strong, too, beyond the greatest expectations of its builders. Clarence Chamberlain, the noted flier, before an audience of interested aviation experts, took the small, single-seater land plastic plane aloft from the Manchester, N. H., airport.

With an engine of 32-horsepower, only, he flew it at 125 miles an hour, took it to an elevation of 3,000 feet, put it through all the stunts applied by test pilots. The craft performed perfectly, he declared, when he landed it.

There were many things about that plastic plane to astonish any airplane builder. True, together with forms and moulds, the thing had cost about $6,000, but the materials, aside from the engine had cost less than $60; labor came to about three times that figure. Furthermore, the engineers figured that with experienced hands similar fuselage and wings could be built and assembled, ready for the engine, in eighty man-hours, and that in commercial production, with the cost of forms and moulds spread over many planes, such craft could be turned out to sell at $750, engine included. The plane, ready for the air, weighed less than 650 pounds.

After tests were completed, Atwood removed the engine and floated the fuselage and wings in a pool adjoining his laboratory, weighted them down with two tons of rocks. This ordinary land plane, without floats or pontoons, after eight months in the pool, carrying the execssive load, sank only two inches.

Then, the plane was taken out of the pool and anchored on the roof of an outbuilding, for study of weathering effects. It stayed there eighteen months and its surface remained as smooth and strong as ever. It was there when the hurricane of 1938 swept over New England. The big blow jerked the plane loose from its moorings, carried it more than a quartermile through the air, hurled it against a pine tree. A wing was knocked loose from the body in the crash but the wood and plastic structure came through without a crack or a dent.

Obviously, then, Harry Atwood had built a plastic plane that could take punishment, one that could be built quickly and cheaply, lighter but still tougher than ordinary aircraft. Still the aircraft industry didn't seem to be interested; there was no great incentive, just then, to lure them from established practises.

However, if that industry wasn't agog over the new material, others were. Word soon got around of this stuff that was so cheap to turn out, so strong and durable in its finished form. Designers saw great decorative possibilities in weaving varicolored woods, covering them with transparent plastic.

Today, four of the largest corporations in the United States and several smaller ones are paying the inventor royalties for licenses under his patents, to make the material. From it, they are turning out luggage, portfolios, cigarette cases, table-tops, decorative panels, wall boards and an amazing variety of other articles in everyday use, finding a ready market for them.

And now, too, interest in the plastic plane is springing back to life, spurred by the wartime demand for planes in Europe, by our own rearmament program. The call is for aircraft in great numbers to be turned out in the shortest possible time. It is not improbable that the wood-plastic plane will show the way to speed production that will make anything yet displayed seem like slow motion.

Recently, Aircraft Research, Inc., of Bendix, N. J., operating under an Atwood License, has delivered to the Air Corps several such planes for testing. The planes, it is announced, will be put through many months of testing, to establish their practicability as military craft. On the Pacific Coast, Timm Aircraft, of Van Nuys, Cal., has recently completed a two-place, trainer-type plastic monoplane.

The Timm plane was constructed of triple-laminated spruce plywood, impregnated with a phenol plastic. Wings are stamped out in two shaped sections; fuselage and tail in half-a-dozen sections. The same concern is now building a larger plastic plane, of pursuit type, designed for Army testing.

Howard Hughes, the millionaire sportsman round-the-world flyer, has started experimental

[*Continued on page 128*]

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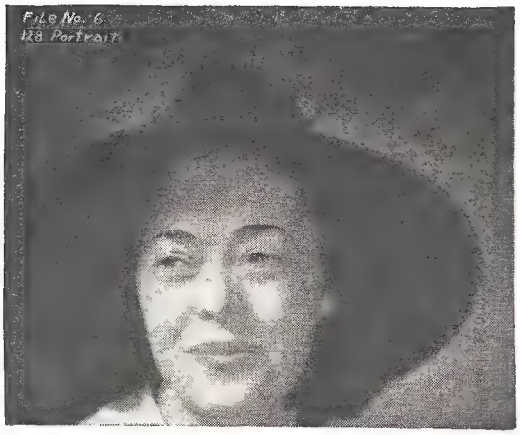
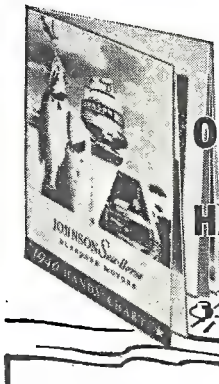


Above: The numbers or other identification marks are imprinted on the negative in the darkroom with indelible pencil before developing the negative. Left: The pencil fogs the negative, which, after development, contains the record, as shown. This print made from above film.



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Harry Atwood—Pioneer

[*Continued from page* 126]

work on a large military plastic plane of the bomber type. The Timm company also contemplates duplicating Hughes' East-West record plane in plastic, believing this construction will add speed. A transparent plastic cockpit cover, light and non-shatterable, is already standard for some types of Glenn Martin bombers.

Meanwhile, Harry Atwood is building his third wood-plastic plane. This is a four-passenger, cabin job, designed for high stratosphere flight. From tail to nose, it is 24 feet long; the cabin is 8 by 5 feet. The fuselage is cigar-shaped, with shell 3/16 of an inch thick, reinforced by plastic-coated wood strips wound radially within the shell; the entire interior is clear of ribs or struts. Windows of clear plastic are woven into the body.

The interior of the fuselage is sealed with a rubber composition and has been tested to withstand an interior pressure of more than 35 pounds to the square inch, a tremendous margin of safety even for altitudes far above any point yet reached by airplane or balloon.

Complete with 150-horse-power air-cooled engine, this four-passenger job will weigh well under 1,000 pounds; a metal plane of like size and capacity would weigh a little over 3,000 pounds. It is estimated that, with costs of moulds and forms spread over a commercial number of such planes, the costs would warrant a sales price of $1,200, most of that for the engine. Speed will be in excess of 200 miles per hour.

Those are the specifications that Harry Atwood has given to the writer; he says that they are all that would interest an aviation enthusiast. But there are things going into the ship about which he will tell no one.

He makes no concealment, though, of the fact that his greatest interest is in inter-stellar flight, that he believes that instead of a vacuum out beyond the stratosphere there is a medium that will float the proper sort of airship, just as the atmosphere floats our aircraft of today. The plane he's building now, he says, is only experimental; his next one will really go places where no one has ever been before.

Already, Harry Atwood's inventions have earned him close to a quarter-million dollars; nearly every dollar of it has gone back into experimental work. He has never asked anybody else to put a dime into his ideas. His income from licenses to use his wood-plastic material is a good one; all of this, too, is being put back into development work. It's costing him a scad of money, but it is probable that no man in the world gets a greater kick out of life than does Harry Atwood.

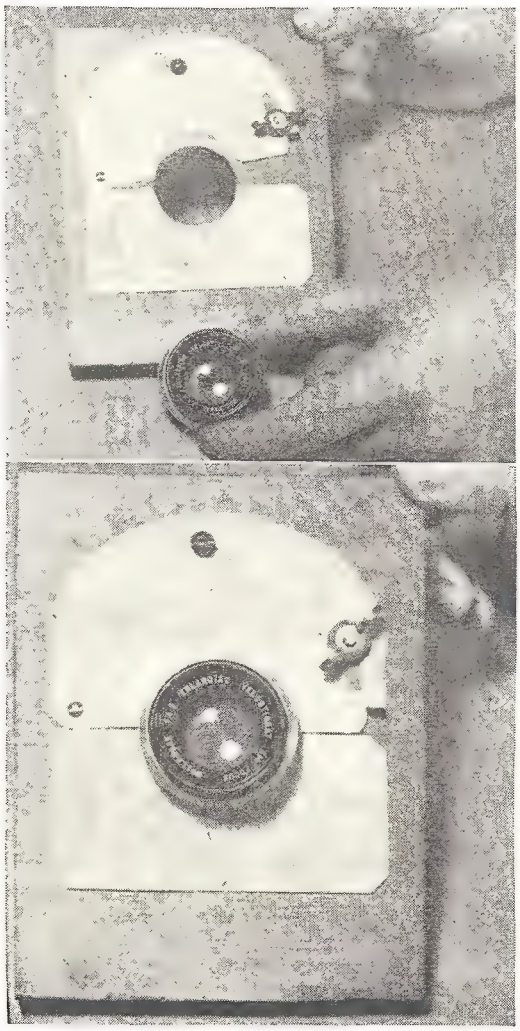
To warm up an airplane for starting in Little America, machinists of the Byrd expedition have to place stoves beneath the hooded motors of the plane.

Lens Board Adapter For Odd Lenses

When an amateur makes his own enlarger or wishes to adapt a different lens to his camera, he is immediately faced with the problem of attaching the lens to the lens board. Most odd size lenses do not have the flanges available for them and the cost of having one made makes it an expensive proposition.

To solve this problem, the simple lens clamp shown in the photos below can be constructed in a few minutes to fit on any suitable lens board.

Cut two rectangular plates of sheet brass or tin, as shown, having in one end a semi-circular cut out, the exact diameter of the lens mounting. When matched together with the cut-outs facing, a hole should result that will hold the lens snugly. Notice sliding arrangement for one side of the special flange.



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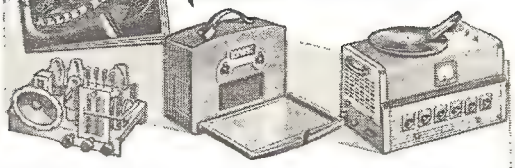

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Proving It's A Plastic Age

[*Continued from page* 63]

Sando, Senior Biochemist, Bureau of Agricultural Chemistry and Engineering of the U. S. Dept. of Agriculture, is the scientist who devised and developed the technique of imbedding specimens by a modern, man-made process which nature suggested in the preservation of prehistoric insects found imbedded in ice in the Arctic regions, and in amber or other natural gum resins elsewhere.

Acrylic resin is a chemical compound akin to amber, which is merely resin that has undergone heat and pressure in nature. Insects thousands of years old have been found perfectly preserved in amber. Dr. Sando is too cautious to claim such immortality for his specimens but hopes to simplify the process and make it so practical that it will do away with the present system of jars filled with alcohol and formaldehyde, now in use in medical and similar schools.

Some specimens require as long as a month to prepare. First, they are dehydrated by drying in air or washing with alcohol, for moisture causes cloudy spots in the mount. Precautions must be taken to prevent solidification of the highest quality liquid resin used, in transit, from the manufacturing plant. Later, when changing from a syrupy to solid state, part of the process must be often carried out under vacuum to prevent the formation of air bubbles. The finished specimen is imbedded in a block clearer than glass, and is valuable historical evidence, easy to handle, transmits colors faithfully, and the mount may be ground to a lens, if desirable, to permit magnification of details.

Fruit Farmers See New Light

[*Continued from page* 61]

installed infra-red lights in his groves. A year later, they were tried in a number of other groves located along the two-hundred-mile stretch between Santa Barbara and San Diego, California. In all cases they proved completely successful. No fruit was lost during freezing temperatures, although no other means of heating was employed.

The globes used were therapeutic infra-red lamps of 7,500 to 10,000 angstrom unit rating. They are strung on lines between the rows of trees. The thermostatic control can be set to turn the lights on at any temperature. Cost of operating the lights is only one-sixth that of smudge pots. However, the cost of installation is about $90 per acre more than for pots.

Last year trees which received 187 hours of infra-red lighting grew three and a half feet. They are now the largest six-year-old trees in California. As infra-red light has a tendency to speed growth, it is believed that the light performs the double function of protecting the groves from frost and increasing the growth of the trees. With the infra-red lights turned on, a grove is sufficiently lighted to permit work at night.

Mileage Is What You Make It!

[*Continued from page 77*]

a gas with a low octane rating will give a fuel knock at a slower spark setting than one with a higher octane rating. The reason for this will be explained later.

Take advantage of the times when your car is on a hoist to test the wheels for dragging brakes. It is only necessary to spin each wheel to do this. If a brake is dragging you can hear it. This may be done just as effectively by jacking up each wheel separately and turning it. A dragging brake can pull down mileage seriously, and it is something that you are not likely to notice or even suspect unless you look for it.

Wheels out of alignment, or the increased friction of under-inflated tires will decrease both your mileage and the life of your tires. Check them regularly, and don't be afraid of air pressure increase from hot weather. Tests have shown that expansion from this cause is very little under any but extreme heat conditions.

Likewise, keep your battery fully charged. If your primary circuit is weak, the secondary circuit will also be weak, with consequent inefficient ignition. Leaky cables or greasy or worn wire insulations will have the same effect.

Friction at any point is always a mileage factor, and careful lubrication and bearing adjustments are important. A wheel bearing that is too tight acts as a constant brake, and so does a dry one. The heavier the oil or grease, the more drag on your motor. Contrary to a common belief, a light oil is a better lubricating medium than a heavy one. Use the lightest oil that is consistent with the condition of your motor. Laboratory tests have shown that oil does wear out, certain essential parts being destroyed under motor conditions which can never be replaced. For this reason, as well as to remove the abrasive impurities that collect in spite of filters, the periodic oil change is necessary.

Don't neglect to have heavy differential and transmission grease changed seasonally. Grease that is suitable for summer driving will pull like glue in winter.

The most efficient fuel for an automobile motor is one that will not ignite except by spark or flame, and should not ignite from engine heat. For this reason, in the better grades of gasoline the rate of combustion is slowed down by the addition of cracked gasoline or ethyl fluid. This prevents combustion knocks which are caused by improper ignition.

The combustion knock, or "ping," is both harmful to motor parts and wasteful of power. It is not just a noise, but a definite force. The difference between this and correct combustion may be compared to the difference between a sudden blow and a steady push. It is produced as follows: the first portion of the fuel in the firing chamber ignites from the spark, while the other part farthest from the plug is ignited, not from the advancing flame,

[*Continued on page 132*]

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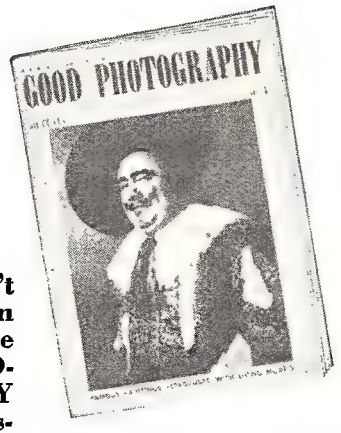

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Mileage Is What You Make It!

[*Continued from page* 131]

but by self-ignition caused by pressure increase from the burned portion's expansion. When pressure waves from these two separately burning portions meet, the result is the detonation which is called the knock, or ping. Power is generated too rapidly for the motor to absorb, and the excess is wasted in the form of heat.

Retarding the spark reduces the ping by delaying the ignition, but at the expense of "snap."

Regardless of the kind of gas you use, or the condition of your car, you cannot get good mileage with wasteful driving habits.

Don't expect economy at high speeds. A recent test showed that mileage dropped from 20 m.p.g. at 30 miles per hour to 10.5 m.p.g. at 60.

Speeding in second or low gears, too fast idling, or racing your motor is pure waste, and unnecessary choking is simply throwing away miles.

You shoot a charge of raw gas into the motor every time you step on the accelerator, and a nervous foot wastes its weight in gasoline from every gallon. Learn the feel of your car, and practice reasonable acceleration.

In general, keep in mind that all parts should always be kept in good condition; employ only mechanics who know their job and have modern equipment; don't neglect the facilities of your service station; keep your own eyes and ears open for defects, and your increased mileage will more than repay your expense and trouble.

Correct Answers to Quiz on Page 65

1. True	13. False
2. True	14. True
3. True	15. True
4. True	16. True
5. False	17. True
6. False	18. True
7. True	19. False
8. False	20. False
9. True	21. False
10. False	22. False
11. False	23. True
12. True	24. True

25. True

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The MI Streamwing

[*Continued from page* 87]

achieved. The model should glide perfectly at the balancing point and only the wrong angular settings on the wing and tail will prevent a long, smooth, flat glide. If the model tends to glide steeply, check the stabilizer adjustment for positive incidence and the wing for negative. Negative incidence, or not the prescribed 2 degree positive incidence on the wing will result in a steep glide. Positive incidence on the stablizer, or not the prescribed two degrees negative incidence will also cause the same results. If the model tends to stall or "mush" exactly the opposite condition prevails. From experience it is always better to have your model gliding slightly steep rather than wanting to get the utmost glide immediately. Usually this will cause the model to loop under full power with disastrous results. If, however, you carry out the instructions accurately you will encounter no difficulties whatsoever. You will be delighted to see the *Streamwing* point its aerodynamic nose skyward and then glide slowly and gracefully to a realistic three point landing.

Blueprints for the MI *Streamwing*, with all ribs and bulkheads full size, are available for $1.00 postpaid. Send check or money order to Fawcett Publications, Inc., Greenwich, Conn. Blueprint No. 320.

Gypsy—15-Foot Canoe

[*Continued from page* 94]

bow and stern a finished look and either paint or varnish the inside.

Bill of Materials, "Gypsy"

Lumber, etc.:

1	Panel ½" Super-Harbord waterproof plywood (4'x8') for moulds, stem, stern, and seats.
1	Piece ½"x8"x14' cedar, spruce, pine, or redwood for bottom board.
6	Pcs. ½"x1¾"x16' like material for stringers.
1	Piece ¾"x¾"x12' same for seat bracing.
90	Pcs. ⅜"x¾"x16' for strip planking.
1	Pc. ⅞"x13"x3' 6" cedar or pine for end cheeks. Put on in two widths if you cannot get this wide.
5	Pcs. ¾" half-round 15' long for gunwale and bottom rub strips, or make from ⅜"x¾" stock. Oak.
5⅓	Yds. 8 oz. Canvas 66" wide for covering (stock width).
1	Gal. Marine Canvas Cement for laying and filling canvas.
6	Ft. ⅜" half-oval brass for end trim. Holes for screws 6" apart, countersink.

Fastenings:

¼" copper or galvanized tacks, around 400.
¼" No. 8 f.h. galvanized or brass screws, 1 gross.
1" No. 8 f.h. galvanized or brass screws, ½ gross.
¾" and 1½" thin wire nails as required.

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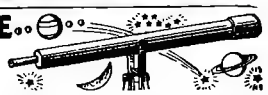

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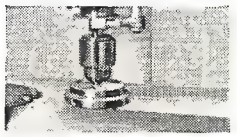

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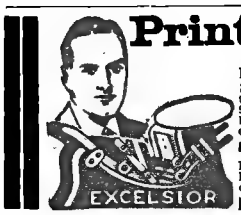

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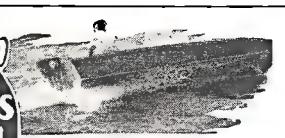

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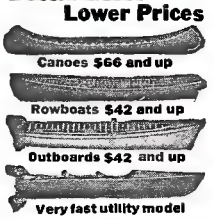

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Make A Night Light

[*Continued from page* 101]

out the idea. In the accompanying drawings are shown three designs and you can take your pick. We will describe the construction of the equilateral triangle box. Here is a list of the materials needed.

Two ⅝-inch clear glass towel rods
One socket with fittings and 6 feet of wire
One 7½ or 10 watt bulb
One maple base 8¼-inches long on a side, ½-inch thick
Three maple sides, 9-inches long, 3¼-inches wide and ½-inch thick
One top 9½-inches long on a side, ⅝-inch thick
Some white enamel, aluminum paint, or the aluminum paper linings from 6 or 7 cigarette packages

First cut the side pieces. Miter the corners so they will go together to form an equilateral triangle. Rabbet the inner, lower edges of each to form an off-set fitting for the bottom. Make two compound saw cuts in the top edge of each—the top cuts being ⅛ or 3/16-inch deep, the inner side cuts about the same depth and 1-inch long. This makes a square shoulder around which the light will not bend, yet provides ample ventilation for the warm air to pass off when the light is on for some length of time. Mount the socket in the middle of one side piece so the bulb will lie midway between top and bottom.

Cut out an equilateral triangle base ½-inch thick with a shoulder to fit the cut in the side pieces. This prevents any of the bottom from showing. Glue and toe nail the mitered corners together. Brad and glue the bottom in place.

Cut the top to fit the top opening, rounding the edges. Rabbet this as indicated and when in place, the top shoulder prevents light from getting through the tops of the ventilation cuts.

Now for the rods. The trend of late has been colored glass towel rods, but we had no difficulty in obtaining the clear ones from a chain dime store. They are (approximately) ⅝-inch in diameter. An alternative suggestion, in the event you can get ½-inch glass rods, is to use 5 of the light elements, instead of 3 of these larger ones, stepping each about ¾-inch, instead of 1-inch apart. The effect will be the same.

Rods of this size cannot be cut as easily as you might suppose. It is not a matter of merely scratching or grooving a line around the place where the break is wanted, then breaking it off. To do so, causes the glass to splinter. So here's a proved method. First grind a shallow groove with the emery wheel. Next, slowly heat in a low blow torch flame until nearly as hot as a flat iron for use. Now rotate the rod slowly, and with an eye dropper drop water slowly in the groove for about 30 seconds If you now break the rod, it will shear off cleanly, which is desirable to admit a maximum amount of light. The three rods needed are 5, 6 and 7 inches long.

Bore three ⅝-inch holes in the positions indi-

[*Continued on page* 135]

Make A Night Light

[*Continued from page* 134]

cated, for the rods, letting the bit extend down to within ⅛-inch of the bottom side of the top. With the next smaller bit, bore the hole on through, causing a slight shoulder which prevents the rod from dropping down into the box when in place. Then place the rods. These may vary a little in diameter, but you can build up with a single thin sheet of paper. Glue all three rods in place with clear household cement, placing the 6-inch rod in the corner and the 5 and 7-inch rods in the other two holes to cause a "step" appearance when the light is in use.

It is desirable that all rods shine with equal brightness. To help diffuse the light inside the box, here are three good methods. One is to give it (and the under side of the top) a coat of aluminum paint. Another is to use white enamel. The third, and best, is to glue aluminum foil over all the inner box surfaces. This done, you cannot tell which rod is closest to the bulb.

To permit replacing burned out bulbs, fasten on the top with three screws—one to a side.

If you like lathe work, you can turn out a hemisphere with ½-inch walls about 6 inches in diameter, and use this, with a base as shown, for the bulb housing. If this is done, mount the socket in the center of the base.

Another suggested design is a band sawed curved piece about 3 inches wide with ½-inch walls and with thin pieces cut to fit and fastened with screws on the front and back sides. This is mounted on a thin rectangular base. Five rods should be used with this design.—*Dale Van Horn.*

Collapsible Cupboard

[*Continued from page* 109]

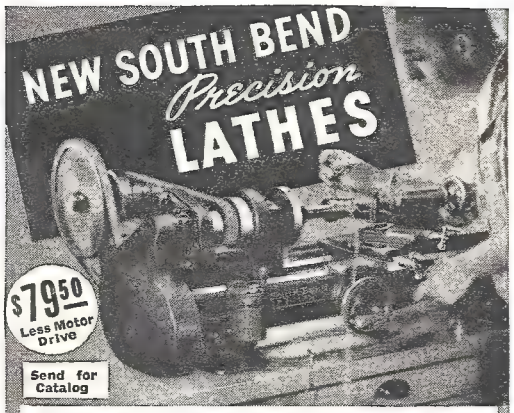
made. Shelving pine ¾-in. thick by 8-in. wide by 20-in. long is used for the shelves. The top, bottom, back and sides of same are made of canvas. There can be four or five shelves and they can be spaced as you prefer. The canvas is screwed onto the shelves, using leather washers to prevent rusting of screws and tearing of canvas. Four holes are bored in the top shelf, through which clothesline rope is threaded for hanging the cupboard. When it is not in use it folds into a small package, taking very little room in your car.—*Claribel Cormican.*

Holder For Razor Blade

[*Continued from page* 97]

in. strip of 24-gauge galvanized sheet iron is cut and bent as shown, the blade inserted and held by a small bolt. An extra supply of blades may be carried in the holder.—*B. N.*

The Allied armies enlisted more than 150,000 homing pigeons during the World War.



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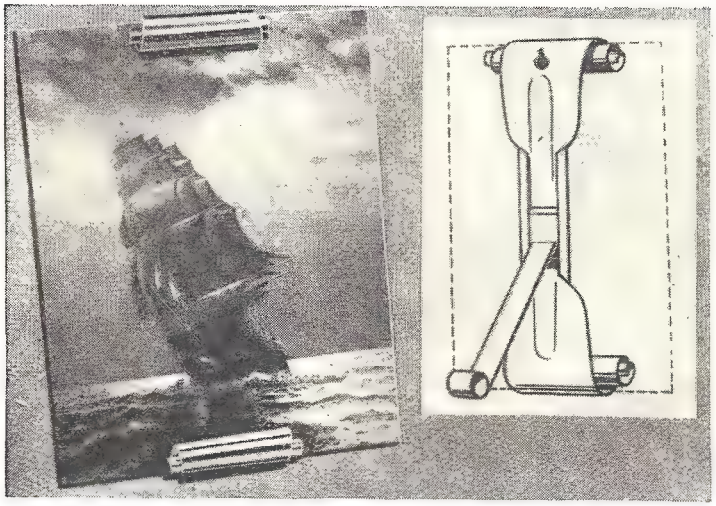

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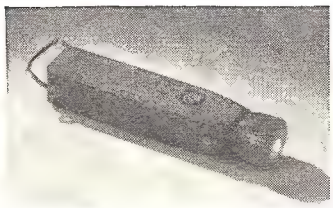
Flashlight is Made for Campers



Scouts, campers and other out-of-doors people will enjoy this new flashlight, because it can be hung from the belt and because it has a small compass built into its barrel. Made of durable, natural-finish wood, the barrel is square and will not roll out of reach.

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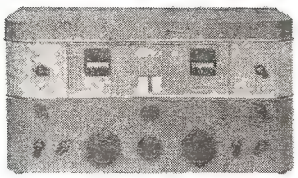
New Receiver for Amateurs



This new radio receiver is designed to provide maximum performance for amateur radio communication, and also finds use whenever a radio receiver is required for distant reception. The 10-tube instrument has many new features, including new treatment of the dials, dual R-F alignment, negative feedback, calibrated bandspread, improved noise limiter and variable selectivity.

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BUILD powerful burnoutproof A.C. welder. Send 20c for instructions. Marvelweld, Box 1156, San Francisco.

Garden Pool And Waterfall

[*Continued from page* 100]

lift is not over ten feet or so. In any case use the size motor recommended by the manufacturer of the pump. Line up the shafts and connect with a flexible coupling. Install the equipment in some sort of housing to protect from the weather. If it is not possible to place the pump lower than the level of the water in the pool, a check valve will be necessary at the lower end of the suction pipe. Otherwise, each time you wish to start the waterfall it will be necessary to prime the pump. This is done where indicated in the drawing; also provides for pumping the pool dry.

This circulating water is fine for goldfish, as it aerates as long as running. Not so good, however, for water plants which thrive in stagnant water, such as water hyacinths.

To simplify the job, measure the lengths of pipe required and have them cut and threaded by a plumber. With a pipe wrench you can install them yourself. It is possible to buy a pumping unit already connected for use: motor, switch, etc.—*Hi Sibley.*

Some states have reserved streams and ponds for exclusive use of women anglers, and Connecticut has a woman fish warden who does teaching duty.

It takes the whole alphabet to list occupations required in making modern automobiles, with at least 47 occupations under the letter C alone, and so on to X-ray man, Yardman, and Zinc plater.

Homemade Tread Regroover

[*Continued from page* 107]

blade of the double edge type to a red glow. Allow it to cool slowly and bend at the middle into a narrow U. Heat the blade red again and quench in water. To assemble, slip the bent blade over the wooden handle and bolt in place.

With this gadget and a little practice "bald" tires can easily be supplied with new treads. It is best to do the job with the tire on the wheel and inflated; it can then be held firmly while the tool is dragged along, plough-fashion.—*I. J. S.*

Red Lantern Stoplight

[*Continued from page* 107]

to the center terminal of the socket solder the wiper arm, L-shaped bracket and lantern cap together as shown. Drill a hole through cap and bracket for the wire. Solder the socket to the inside of the cap, run the wire through the hole and connect to wiper terminal, leaving enough slack in the wire to allow the arm to swing freely. Mount as shown and connect to the regular stoplight wire.—*Denzile Shurte.*

A room with dark woodwork is apt to need 15% to 25% more current for good general lighting than a room with light wood finish.

A zoologist says that there is no known way of telling the age of an adult bird by looking at it—loss of feathers, state of beak or claws may indicate disease, but not old age.

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(See regular classified section for rates and other information.)

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SUPER-WONDER Packet offered, containing 60 different stamps from Afghanistan, Transjordania, North Borneo, Manchukuo, Sudan, Guadeloupe, Iraq, Brunei, French and British Colonies, including natives, beasts, ships, etc. This entire packet for only 5c to approval applicants. Big illustrated lists free. Kent Stamp Company, Box 87(28), G.P.O., Brooklyn, N. Y.

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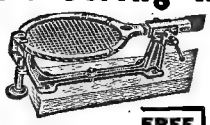

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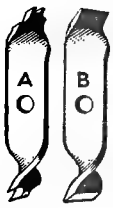
WATCH-MY-TURN SIGNAL CO., Dept. W-626, Walnut Bldg., Des Moines, Iowa



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UNITED MUSHROOM CO.
3848 Lincoln Ave. Dept. 476, Chicago

Hitch Boat To Star Conversion

[*Continued from page* 102]

universal joint. At that point the spline is cut off and the stub welded to a 1" steel shaft of suitable length.

The shaft log is made of 1½" galvanized iron pipe threaded at both ends. About 3' will usually suffice. A pipe cap, drilled to take the 1" shaft, is screwed on the aft end of the log. A 1½" collar is placed on the fore end. A male reducer, reamed internally to the size of the shaft, is inserted in the collar. After a trial assembly, the cap, collar, and reducer are removed to permit pouring the babbitt bearings.

When the bearings are to be poured, the shaft should be wrapped with a layer of thin oiled paper where the babbitt will contact it. String packing must also be wrapped around the shaft and driven down into the shaft log to a distance equal to the desired length of the bearings. A 6" bearing is desirable. A ½" hole must be bored at a point about half-way along each bearing's length and then taped on the outside with heavy greased paper. When the babbitt is poured in, these holes become filled and act as keys, locking the bearings in position. The heavy greased paper prevents the babbitt from running out while hot. In planning the length of the bearings be sure to allow about 1" at the outer ends for additional packing.

After the final assembly with the babbit bearings in place, the outer packing may be tightened by taking up on the collar and bushing at the forward end, or the pipe cap at the rear end. A hole should be drilled in a convenient position to take a grease fitting, as shown in the drawing.

At the point where the log passes through the bottom of the boat, a ⅜" thick iron strip 4" wide and 2' 6" long holds the log rigid. The hole for the log must be drilled through this strip at the correct angle in order to allow a good welding job. The strip is drilled along the edges also, so that it can be bolted to the bottom of the boat.

The thrust bearing is made from a 2" length of 1½" pipe with a babbitt bearing poured into it. The forward end of the pipe is welded to an iron plate 2½"x2'. This is fastened to the stern post with lag screws. A Model T driveshaft bearing is used for a thrust race, with a steel washer between it and the propeller.

When installed, a conversion of this kind may be run in high gear at all times or shifted into lower ratios to facilitate extremely low speeds for trolling. The reverse, of course, is used whenever needed.

Lemonade was sold as a scurvy remedy by medieval pharmacists in Florence, although not until recently has science understood the vitamin C value of citrus fruits.

Carpenter worms are a problem in North Dakota, where they are destroying trees and shrubs in farm shelterbelts.

Make Your Boat Last Longer

[*Continued from page* 111]

rotted section its old life, but you can prevent its spreading, which it will do in a surprisingly short time under conditions favorable to its fungus-like growth. If chiselling out every vestige of rot weakens the member, or it is in a conspicuous place, have the piece replaced entirely; it will be cheaper to do this now than later.

There are several good commercial rot preventives on the market as well as the old-time remedies such as salt, kerosene, whitewash, creosote, copper paint, and so on. Salt certainly combats rot. The outside portion of the hull entirely beneath water in salt water locations has a long life if sap-free suitable woods are used. Following this up, on old ships and on many newly built commercial boats stops were fitted so salt could be packed between the hull planking and the inner ceiling. These stops held the salt up out of the bilge water; still enough of it got down in the form of a briny trickle to preserve the keelson and cross floors. Oak used in these boats became as hard as the proverbial iron as it was literally pickled. In line with this many careful owners throw salt around the bilge every time the boat is hauled out for the winter. Salt not only helps the wood but prevents water left in odd places freezing and perhaps forcing wood away. Throughout the season they put it in odd pockets wherever water collects, and in damp lockers.

Other preventives, even the commercial preservatives, must be applied to wood which is clean, dry, and free of oil, dirt, or paint, as their worth depends on their penetrating into the wood and not merely on surface protection. This makes it almost useless to apply even the most expensive preparation to bilge members which usually have so much oil from the engine on them that it is impossible to get all of it out of the pores of the wood. It is in new construction and repair work that such preservatives are worth their cost many times over.

This brings up the fact that it is useless to paint the bilge of an old inboard powered boat. It is seldom possible to get all the oil and dirt out of the wood and this causes the paint to blister, permitting moisture to lodge beneath the film, causing more harm than good. Likewise do not paint over bubbles or loose paint anywhere about a boat large or small. Break the film, sand down to bare wood, let dry thoroughly, then gradually build up to the surrounding surface.

An open boat requires special care to have it last out the years built into it. If a canvas covered boat shows a tendency to chafe in a certain spot on the bottom see if fore and aft bilge keels or strips cannot be fitted to take the wear of beaching. Otherwise keep chafed places well paint covered so the paint and not the fabric takes the wear. If the covering gets a tiny rip,

[*Continued on page* 144]

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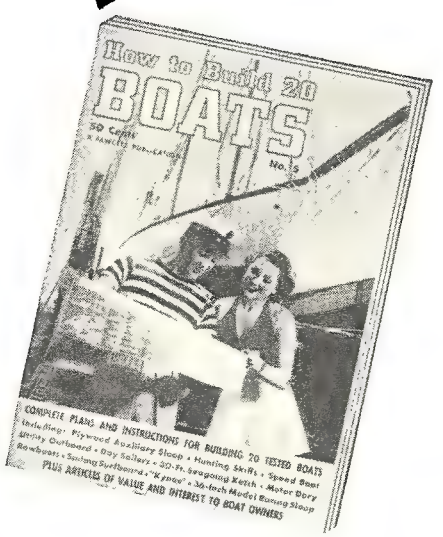

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Make Your Boat Last Longer

[*Continued from page* 143]

mend at once with hard glue and a hot iron so water will not lodge between the canvas and wood to start rot. Correct any tendency to change shape. If seat fastenings work loose drive others in new locations; seats are an important strength member keeping the sides from coming and going. Remedy other small faults as soon as apparent; cover bare wood with good grade paint or varnish, fill and paint gouges, and replace loosened fastenings.

Care and upkeep rather than years of use are reflected in a boat's appearance and ability, as well as help set her resale value.

Marine Lamp And Coaster

[*Continued from page* 106]

face plate turning gives the wheel rim, which is drilled at six points as is the hub, to take the spokes. These parts are glued together with an eye to concentricity. One spoke is drilled to take a bead chain from the socket, which screws to the threaded end of the conduit, the other end of the latter being flared to tightly assemble the parts.

Maple or other varnish stain to match the furniture is used in two coats, then the parts assembled. Secure the rope with small brads, pulling the rope strands well over the brad heads to conceal them, after which, wrap the butting rope ends together with a 1-in. wide adhesive plaster coupling. The sail boat motif is made of thin white plastic, or other contrasting color material, cemented one on each end of the body block, after roughing up a bit with sandpaper to give the cement footing in the varnished surface.

COASTER SET—Lathe and jigsaw produce the members of the coaster holder. The rings are turned on the lathe face plate, where they are also sanded. Eight spoke holes are bored, 45 degrees apart, and holes also made in the base to take the dowel joinings. Spokes are easily and rapidly made by doing seven at a set up and then cutting them apart. The base is sawed to shape and the corners grooved to receive the rope rim. As before, the rope is applied after the article has been varnished. Cut the cork coasters with a sharp knife or razor blade to the size shown.

A Row Coaster

[*Continued from page* 95]

in the drawing. To operate the Row Coaster the oars are pulled in unison, as in a rowboat, the difference being that the Coaster goes in the direction in which the rower is facing. To turn, one oar is dragged and the other one pulled.—*Hi Sibley.*

The United States Coast Guard is 150 years old this year.

Rest On A Tired Boat

[*Continued from page* 88]

tires. They need not be new so long as they hold air.

Inflate them and lay them on the floor in the position shown. Then cut two boards (6" to 8" wide) sufficiently long to form a cross as shown. Bolt them together at the joint and place the inner-tubes on them.

At one end of the long one bolt a vertical piece of 1¼" board for the motor transom. Then using soft wood, 3" wide, bend a gunwale around the form as shown. This can be nailed to the ends of the cross and to the motor transom. Extreme bends can be made easily by slotting the inside surface of the wood with a saw.

Brace the transom to each side of the frame with two diagonal pieces of wood. Uprights about 3' forward of the transom serve as supports for the seat that extends across from one side to the other.

The inflated inner-tubes should then be tied with tape or soft cord to the gunwales and crossed boards so they will retain their position and shape.

The motor should be attached to the transom so the propeller is completely below water when the seat is occupied.

No protection need be made for the inner-tubes as such tubes are tough and will give surprisingly before a snag will puncture them. However, should three be punctured, one inflated tube will keep the craft and crew afloat.

Build several of these "inner-tube" motor boats and the gang can have plenty of fun. Even without motors they can be sailed by making proper provision for a mast and sail, rudder, and a small fin underneath.

Repairing Control Cables

[*Continued from page* 105]

lized, a large cotter pin can be inserted between the end of the cable housing and the end of the lever involved. See Fig. 6. This will usually do a good job for quite a time.

Protecting The Control Cables

The front brake inner cables on either motorcycles or bicycles, if neglected, usually break just outside the anchorage to the handlebar control lever. This is due largely to the effects of exposure to grit and moisture. The trouble can be practically eliminated by slipping a piece of rubber tubing over the end of the cable and taping it into place so that it will fit snugly against control arm. At frequent intervals the lever should be pulled in to its fullest extent and the bare part of the cable smeared with thin grease. See Fig. 7.

Repairing The Cables

When a strand of wire breaks in the front brake control cable, the strand should not be cut off,

[*Continued on page* 146]

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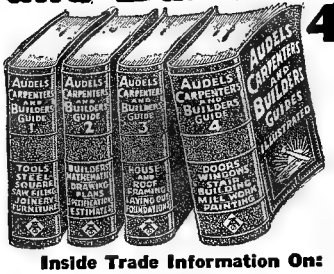

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Build Fence For Your Garden

[*Continued from page 89*]

to the drive. To pep up front yard appearances, a simple picket fence, shown in figure 1, was built in front of the walk, then turned at right angles and extended to the corner of the stoop. 4x4-inch posts with 1x2-inch stringers and pickets, formed the job. The lower end of each picket was set 2 inches above the ground to prevent rotting. Painted white to match the white trim of the house, the few dollars invested in the fence has added much more than that sum to the value of this home.

In Figure 2 is shown a retaining wall that has all the appearance of a garden fence from the low side. It was found on a modernized farm not far from town and lines the main driveway to the yards. The wall-fence is of solid stone, capped with roughly half-rounded stone on top spaced about stone thickness apart. The wall extends well below ground and averages 16-inches in thickness.

Figure 4 shows a pleasing combining of built up stone square, squat columns which are connected with round railings. These poles were cut to length and the ends laid right in the columns when the stones were cast in place, but to prevent swelling of the wood and subsequent cracking of the masonry, a layer of corrugated cardboard was placed around each pole end, first. This is a nice choice of design for the more expansive grounds.

Somewhat similar is the stone-rail fence shown in figure 3. Here the lava-stone predominates but gaps between the short walls are interspersed with hand hewn rails about 4-inches square. Ending at the alley and running along the street side of the corner lot, this fence makes more pleasing the aspect of an otherwise prosaic plot of ground.

Flat limestone laid without mortar joints makes the fence-wall shown in figure 5. Steps are merely these flat stones laid in the ground for the tread while part of the risers are earth. Flowers have been planted in profusion in all the crevises of both fence and steps to give a lovely rustic effect.

Repairing Control Cables

[*Continued from page 145*]

but instead it should be soldered in as a unit with the rest of the wires; as shown in Fig. 8. This will enable the cable to render continued service, lessening replacement expense.

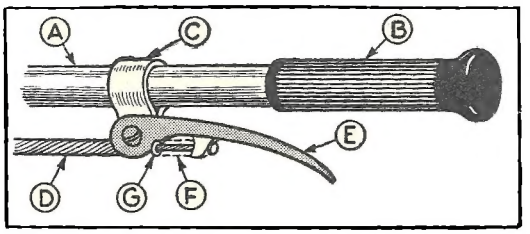

Fig. 7. (A) Handlebar. (B) Handlebar grip. (C) Control lever supporting lug. (D) Control cable housing. (E) Control lever pulled up to expose control cable (F), over which rubber tubing designated by dotted lines, is slipped for protection. (G) Lug to which rubber tubing is taped to hold it snugly against control arm.

Soldering On Nipples

An ordinary teaspoon is a very handy implement for soldering on control cable nipples. It is used as a miniature melting pot for solder. The motorcycle or bicycle control wire and nipple can then be simply dipped in the molten solder instead of being soldered with an iron. By this method there is far less chance of making an unsatisfactory job. The saving of solder is considerable.

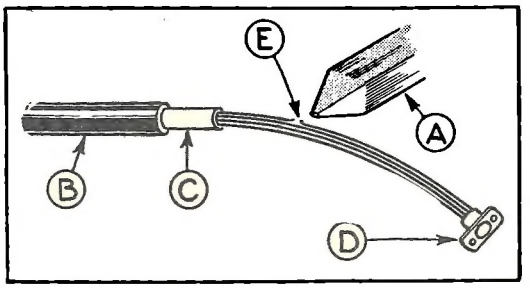

Fig. 8. (A) Soldering iron. (B) Control cable housing. (C) Control cable housing cap. (D) Control cable nipple. (E) Broken wire to be soldered as a unit with several of the other wires.

GOIN' FISHIN'?

If you're heading straight for a little angling this summer be sure to get yourself a July copy of MECHANIX ILLUSTRATED, on sale June 1st for only 10c. The How to Build Section will include an article and sketches on rewinding old rods to make them as good as new, plus many other ideas and gadgets to increase your fishing enjoyment.

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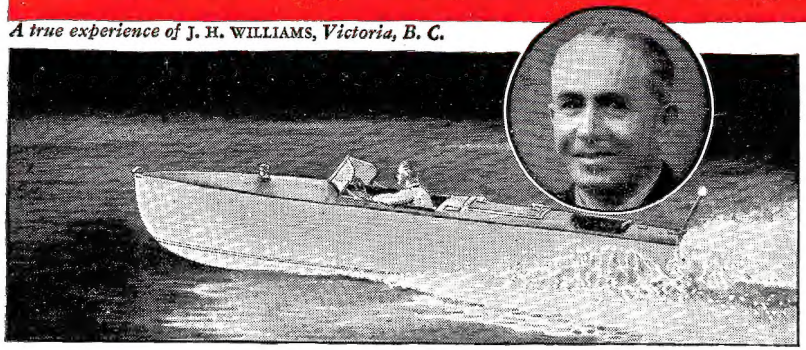

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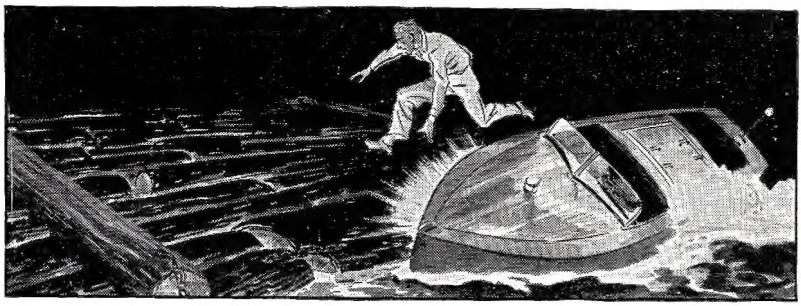

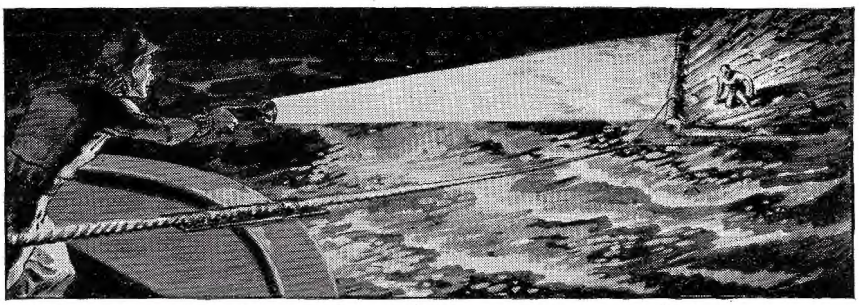

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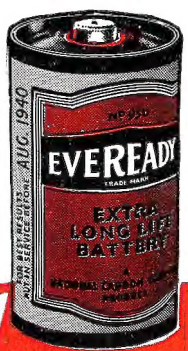
(Signed) J. H. Williams"



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